

The Mining Journal

Established 1835

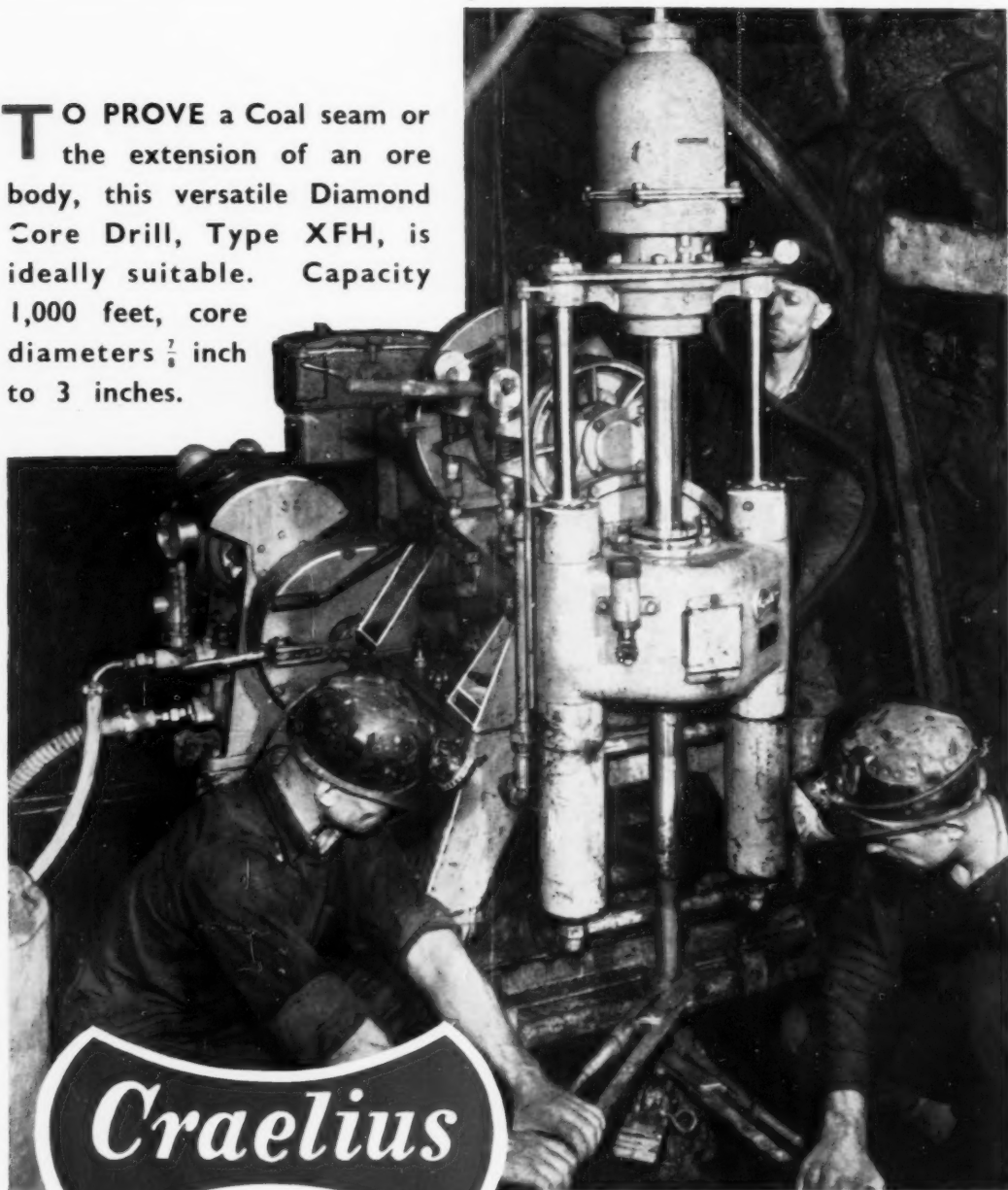
Railway & Commercial Gazette

Vol. CCXLVI No. 6282

LONDON, JANUARY 13, 1956

PRICE 9d.

TO PROVE a Coal seam or the extension of an ore body, this versatile Diamond Core Drill, Type XFH, is ideally suitable. Capacity 1,000 feet, core diameters $\frac{7}{8}$ inch to 3 inches.



Craelius

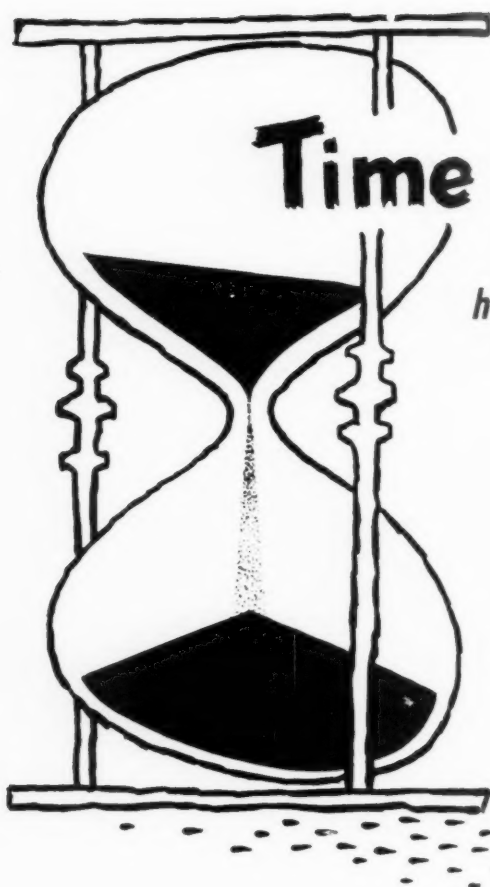
ASSOCIATED COMPANIES :

The Swedish Diamond Rock Drilling Co., Stockholm.
The Craelius East African Drilling Co., Ltd., Nairobi.
The Electrical Prospecting Co., Stockholm.
Societe Anonyme, Craelius, Paris.

Photograph by kind permission of the National Coal Board.

CRAELIUS COMPANY LIMITED
12 CLARGES STREET, LONDON, W.1.

Telephone: Grosvenor 1378/9
Telegrams: Craelius, London.



MASS-
IMPREGNATED
NON-
DRAINING

CABLES

an original

BICC

DEVELOPMENT

UNITED KINGDOM PATENT No. 581,830



OVER 3,000 MILES ALREADY IN USE

Publication No. 308 is
available on request



BRITISH INSULATED CALLENDER'S CABLES LIMITED
 21 BLOOMSBURY STREET, LONDON, W.C.1

If all our spares were laid end to end...



25,000 different types of spare part would cover quite a lot of ground - if we had the time to lay them end to end. But, carefully docketed and packed, they're ready now to cover quite a lot of ground in another way - ready, in fact, to be despatched to any corner of the world at short notice. We realise well enough how vital this side of our service is, for a Joy machine

lying idle can knock the bottom out of any production programme.

Even the finest machines in the world need spares and sometime or other one of our drills, loaders, haulages or coalcutters will begin to slacken its effort. When that happens you can be sure that we'll measure up to your needs. It's 25,000 to one that we do.

THE JOY-SULLIVAN SPARES SERVICE



JOY-SULLIVAN LTD. • P.O. BOX No. 2 • GREENOCK • SCOTLAND
EXPORT SALES: 6 CARLOS PLACE • LONDON W.1.

ALUMINIUM AT WORK



From the familiar to the less familiar

Wherever there is movement there is a need for less weight. That is why aluminium is chosen for the hard-working pistons of the world's engines. Its lightness and durability

have made a vital contribution to the development of engines giving higher power for less weight. And now aluminium is raising the limiting factor of weight in many kinds of

electrical apparatus. For example, by lightening the windings of great alternators, aluminium allows size to be increased—and more power can be made from every ton of coal.



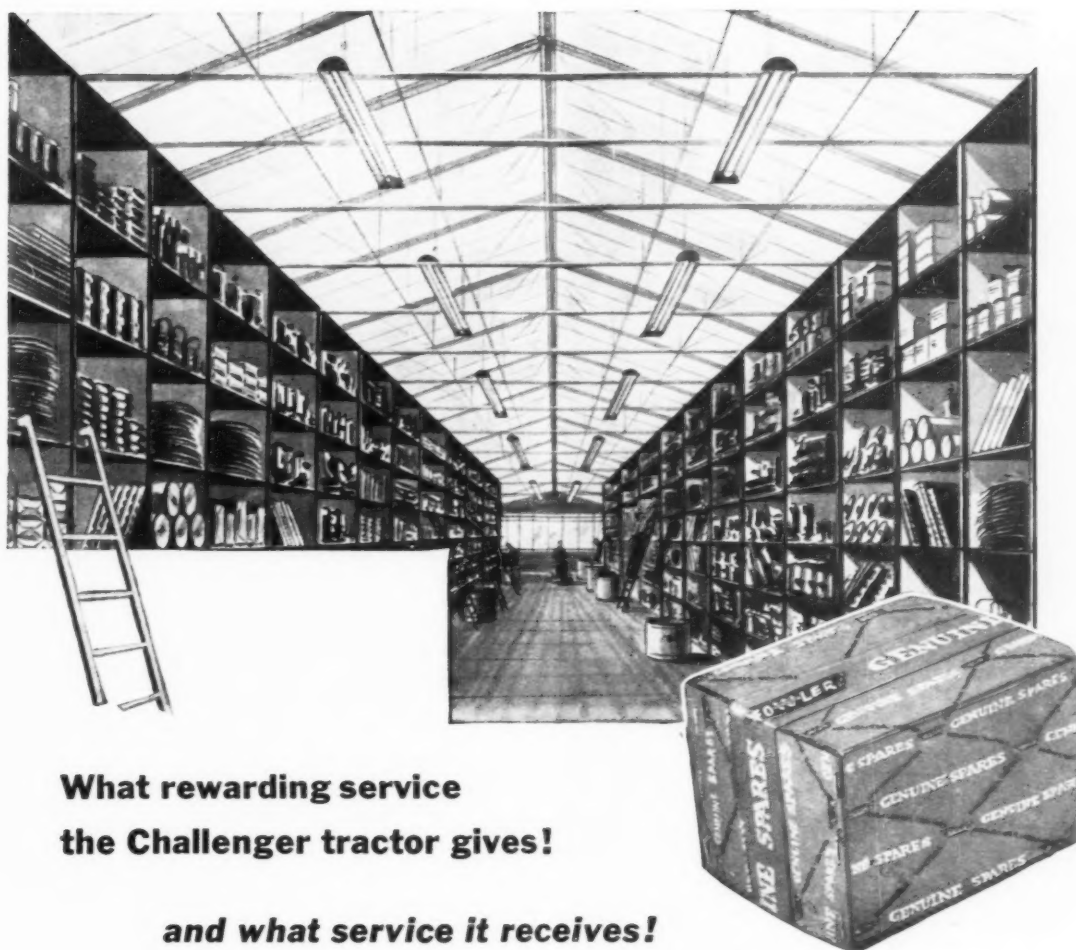
Aluminium Union Limited

(Incorporated in Canada)



THE ADELPHI, JOHN ADAM STREET, LONDON, W.C.2. An ALUMINIUM LIMITED Company

OFFICES, ASSOCIATED COMPANIES AND AGENTS THROUGHOUT THE WORLD



**What rewarding service
the Challenger tractor gives!**

and what service it receives!

The crawler tractor is the tank of peacetime. It is the trump card in any offensive against jungle, forest, desert or difficult terrain. As with an armoured division, the success of the operation depends on keeping the heavy equipment in first class running order, and keeping it right in at the guts of the job.

The service a Challenger tractor gives is only equalled by the service it gets. In every part of the globe, wherever there are Challengers in action—Fowler distributors are there to provide rapid and efficient servicing, and to supply quickly and economically any spares that may be needed.

More earth moved faster by Challenger

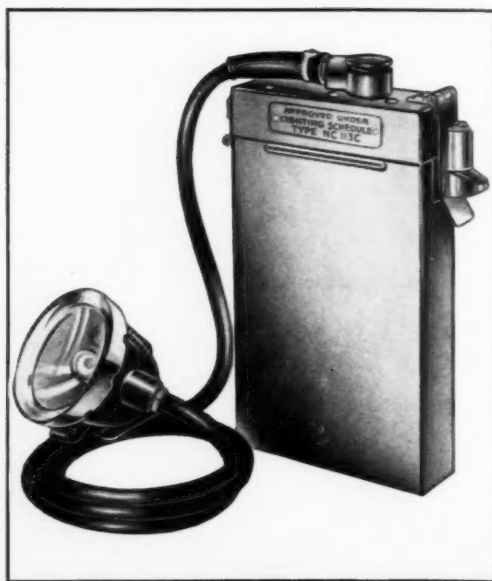


John Fowler & Co. (Leeds) Ltd., Leeds 10—A product of the Marshall Organisation

Concessionaires for Great Britain: Thos. W. Ward Ltd., Albion Works, Sheffield 4



His life may depend on his lamp...



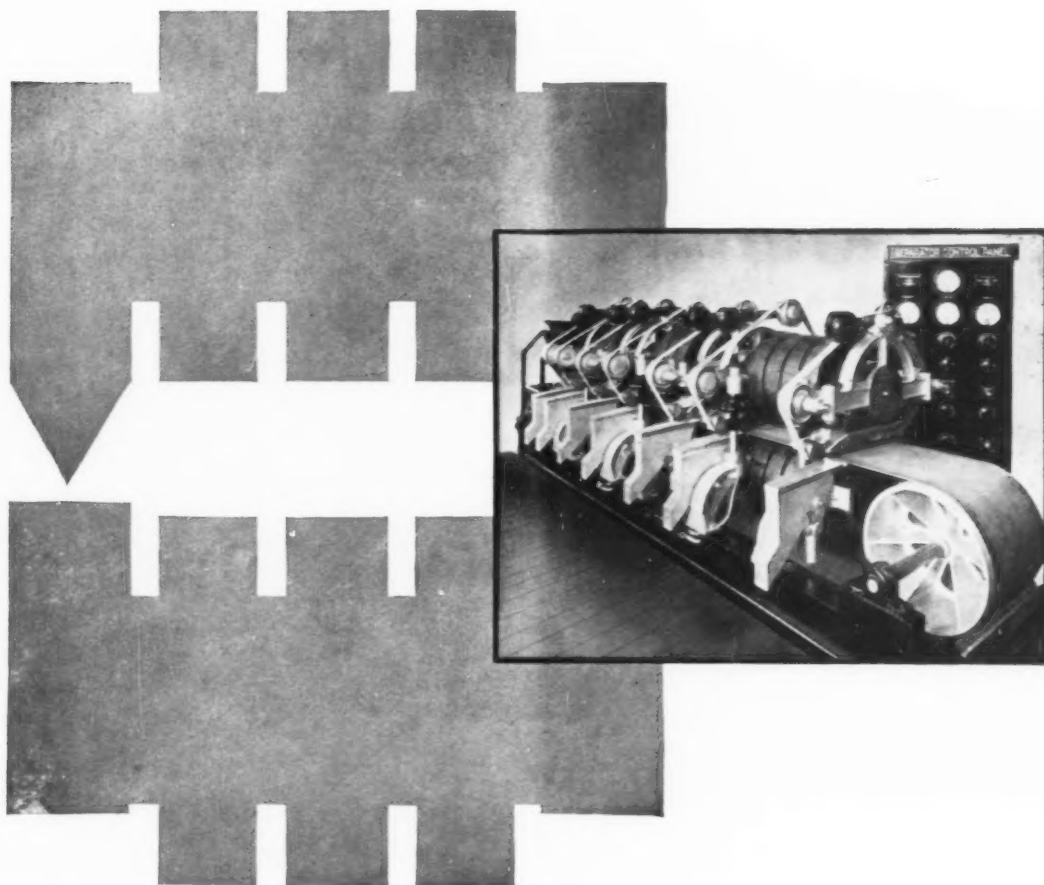
NIFE

**The first leakproof alkaline
cap lamp with
the new nylon safety vent**

REDUCE YOUR OPERATING COSTS by installing the
Nife Alkaline Cap Lamp self-service system

NIFE BATTERIES • REDDITCH • WORCESTERSHIRE

N57B



THE *key* TO EFFICIENT MAGNETIC SEPARATION

The highly efficient separation and greatly increased capacity of the Huntington Heberlein High Intensity Magnetic Separator are due to the intensely magnetic fields which permit a maximum depth of feed band. Between each magnet assembly the feed layer is vibrated to promote efficient separation.

The standard 18" feed belt machine separates seven products of varying magnetic characteristics and one non-magnetic fraction. Feed and cross belt speeds are

independently controlled and capable of wide variation so that the machine may be used to separate a wide range of feebly magnetic materials.

The many repeat orders for this machine are proof of its superiority for the separation of columbite, wolfram, ilmenite and associated minerals.

Specialities include Ore Concentration Plants, Metallurgical Plants, Ore Roasting Plants, Sintering Plants and Chemical Plants.

High intensity magnetic separators by
Huntington, Heberlein & Co. Ltd

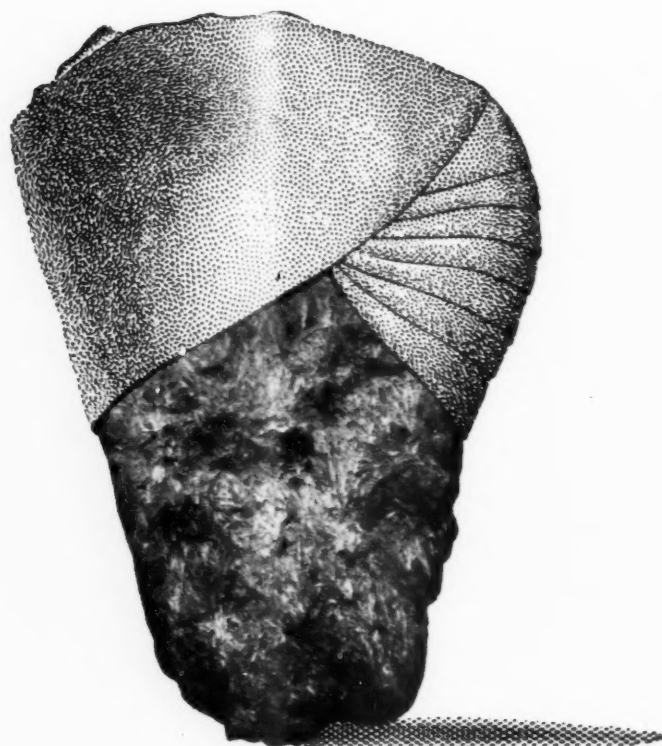


114 CROMWELL ROAD, LONDON, S.W.7.

Telephone: Fremantle 7711/2/3

Telegrams: Innovation, Wesphone, London

MH17/PS



Star of India

Think of India—and today you think of Kyanite, a mineral with a bright and sparkling future. Indeed, a profitable one—provided the choice of plant and treatment is sound. To assist you in your choice, our Research Chemists and Mineralogists will analyse your ore sample, treat it in experimental plant and submit a full report. With this report will come recommendations for machinery and process. This service is explained in Publication F. & C. 2284 entitled "Mineral Dressing". A copy will be sent to you gladly on request.

FRASER & CHALMERS**SERVING THE MINES OF THE WORLD**

FRAZER & CHALMERS ENGINEERING WORKS • ERITH • KENT

THE GENERAL ELECTRIC CO LTD OF ENGLAND

F.C. 89

STYLE 'E' CRUSHING ROLLS



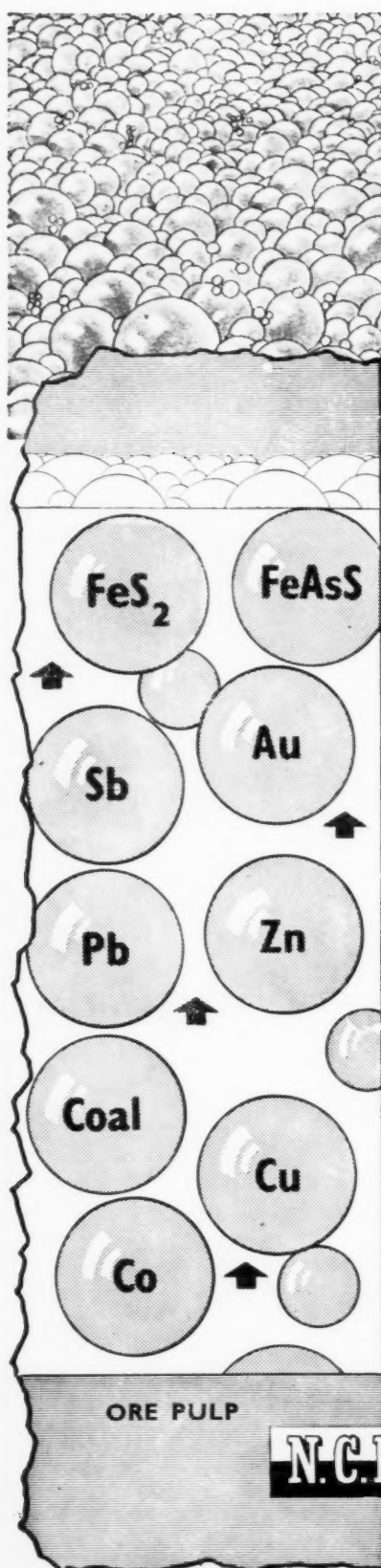
Hadfields manufacture massive "E" Type Crushing Rolls for Ironstone in a range of sizes from 3' x 3' to 6' x 5', the largest size being capable of an output of up to 900 tons per hour.

"E" Type Crushing Rolls combine all the advantages of hammer mills and rolls in one machine.

Style 'E' Roll Shells fitted on Forged Steel Shaft.

HADFIELDS
SHEFFIELD

HADFIELDS LTD., EAST HECLA WORKS, SHEFFIELD, ENGLAND



"T. E. B."
FROTHER
PLUS
 Related Compounds blended to
 suit widely varied ores.

ECONOMICAL! STABLE!
FLEXIBLE! PROVED IN THE PLANT!

N.C.P. Metallurgists will study your problems *on the plant*, and where particular conditions call for special treatment, N.C.P. will provide a blend of alkoxy hydrocarbon frothers to suit your needs.

Manufactured in South Africa from South African materials.

** Use protected by patent*

Apply for information sheet which gives full technical details of physical properties, flotation behaviour and chemical composition.

N.C.P.

NATIONAL CHEMICAL PRODUCTS LTD.
 P.O. BOX 344, GERMISTON
 Transvaal, South Africa

Flame test shows that Conveyor Belting made with GEON PVC is safer!

This flame test—a modification of that specified in B.S. 738—clearly demonstrates the safety and flame resistance of conveyor belting made with Geon PVC. Two pieces of belting—one rubber, one made with Geon PVC—were used in this test. Both were subjected to a bunsen flame (ca. 1800 C.) for three minutes. After the bunsens were removed the rubber belting was still in flames and partially destroyed, but the belting made with Geon PVC had neither caught fire nor continued to flame. This test underlines the reason why Geon PVC is making an outstanding contribution to safety in the mines.

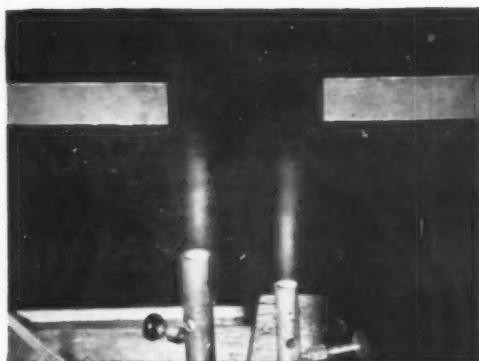
*Geon PVC materials are polyvinyl chloride plastics.
Write for descriptive booklet No. 112 free on request.*



"Geon" is a Regd. Trade Mark

BRITISH GEON LIMITED

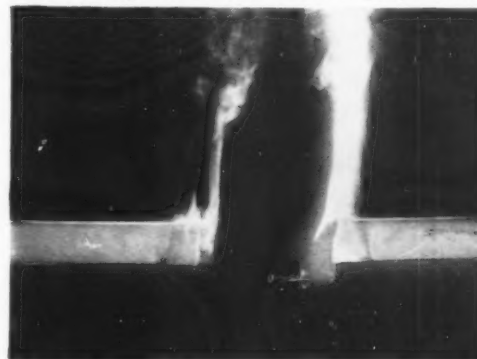
Sales & Technical Service: DEVONSHIRE HOUSE · PICCADILLY · LONDON W1 · TELEPHONE: MAYFAIR 8867



Stage 1 Before the start of the test, Geon PVC belting on the left, rubber belting on the right.



Stage 2 Both bunsens moved into position simultaneously. Rubber belting in flames. Geon PVC belting only charred.



Stage 3 Bunsens removed. Rubber belting continues to burn fiercely; partially destroyed. PVC belting, though smoking, is seen to be hardly affected.

CAPPER PASS

***purchase for smelting
and refining***

***Complex & Low Grade
tin bearing materials***



send samples or analysis to

CAPPER PASS & SON LIMITED, NORTH FERRIBY, YORKSHIRE, ENGLAND

The Mining Journal

Established 1835

Vol. CCXLVI No. 6282

LONDON, JANUARY 13, 1956

PRICE 9d.

CONTENTS

Notes and Comments	43	Machinery and Equipment	53
From Our Own Correspondent	45	Mining Miscellany	55
Australia: Western United States		Metals, Minerals and Alloys	56
High Temperature Metals and Alloys	46	The Mining Markets	58
Opencast Mining at Nchanga, N. Rhodesia	47	Company News and Views	59
Nuclear Energy Needs of O.E.E.C. Countries	48	Company Meetings and Announcements	61
Development of Zirconium Technology	50	Anglo American Corporation of South Africa's	
Recent Canadian Mining Progress	51	Orange Free State Group of Mines; Tanganyika	
The World Coal Mining Industry	52	Concessions Limited; Burma Mines Limited	

Published by The Mining Journal Ltd., at 15 Wilson Street, Moorgate, London, E.C.2. MONarch 2567 Subscription £2 5s. per annum

NOTES AND COMMENTS

Depressing Long Term Outlook in Chile

The outlook for the copper industry in Chile is not very much better; in fact in some respects it seems a good deal worse. This must appear a gloomy view to take up now that the strike of the three big American mines has ended—ended what is more without causing more than the faintest flutter on the London Metal Exchange. But it is the long view that matters in Chile and it is the long view that is depressing.

It was pointed out in "Metals, Minerals and Alloys" last week that the Chilean Government was already showing signs of losing its resolution; it had offered to redraft the copper statute after insisting that it must be adhered to, it was preparing to negotiate with the workers after saying that it would not while they stayed out, it had threatened to conscript the strikers but failed to do it, it had tried to recruit fresh workers and had passed the job to the companies when recruits failed to appear. The signs were all too clear that the Government has had to accept ignominious defeat after proclaiming its intention to fight to the end. The workers secured the complete rejection of the copper statute while at the same time extracting the bonuses that the statute provided for them. On the whole this defeat seems more damaging than the victory which the Government has won over the Central Union of Labour in its strike against the anti-inflation programme.

Neither the copper workers (who presumably wanted to recoup their strike losses before coming out again) nor the independent unions agreed to join the general strike so that its chances of success were weak even before it started. In the event the strike collapsed within 24 hours. However, there is no denying that Chilean workers are determined in their opposition to the terms of the anti-inflation bill and the battle is far from won. (The bill which was discussed together with its implications in this column on December 2, provides for freezing prices at the level ruling on November 16 and limiting wage rises in 1956 to 50 per cent of the extent of the rise in the cost of living in 1955). Strikes are more likely to be effective if called against a specific refusal to raise wages than against a general ban on wage increases and the Central Union of Labour can

be faulted for deciding to take its stand on the wrong ground. What really matters is whether the Government is prepared to see its programme through come what may.

It must be said, on the evidence of the Government's action during the copper strike, that its determination is not great. But the importance of controlling inflation is paramount. In the first place the World Bank and other potential lenders are insisting on a more rigid control of inflation before consenting to increase their investments, and in the second, Chile is losing all the benefits of high copper prices through the depreciation of the currency. Furthermore, while the wages-prices spiral is twirling away there must be a continuing danger of strikes over wage demands and this threatens not only Chilean stability but the very future of copper as a reliable raw material.

However, the particular method of combatting inflation chosen by the Government demands resolution more than anything else. For if a policy of freezing breaks down the sharp rises that follow are likely to raise the rate of inflation to an even higher level. This is not to approve the policy either as economically sound or as equitable. It is at best a rough and ready method, but since Chilean banking structure is somewhat primitive more sophisticated methods have to be ruled out. The Government has clearly won the first round of the battle though it was lucky to have to fight on ground that suited it more than its opponents and its opponents have made clear their intention to fight again. The Government must be wished well in its fight against inflation—but it would be wise not to let the wish father too many thoughts.

Minerals by the Billion Dollars

According to a summary issued by the Bureau of Mines, mineral production in the U.S. jumped last year to an aggregate value of \$15.8 billion, thus substantially exceeding the previous record of \$14.4 billion established in 1953. The value of last year's metallic mineral output is estimated at \$2 billion. The rise in value last year is ascribed almost entirely to increased production. The chief cause of the upswing was substantial expansion in the production of liquid and gaseous fuels, bituminous coal, copper and iron

ore, in that order. Zinc, lead, manganese ores and tungsten also recorded large value increases.

Even allowing for the difference between American and British billions, the value of the U.S. mineral production in terms of dollars has become so astronomical as to be almost meaningless to the average man, to whom a mere million dollars is wealth indeed. The growth of the mining industry in the U.S. has its origin, of course, in the insatiable demand for minerals and metals which is symptomatic of the present phase of Western civilization, but the expansion of domestic production has been accelerated by the minerals policy of the U.S. Government, which seeks to minimize the country's dependence on imported sources of supply. From the upward trend in the value of the domestic mineral output, it is evident that from a short-term point of view efforts towards increased self-sufficiency have borne considerable fruit. On the other hand, the very magnitude of the figures suggests that over a period the very success of this policy must have the reverse effect. Although the high level of prospecting activities is continually resulting in new discoveries and technological progress is extending the lower limit of payability, the scale of production is so vast that sooner or later resources of many minerals must become exhausted, thus rendering the U.S. more dependent than ever on importation.

No less spectacular is the progress of Canada's mining industry, which also reckons the value of its annual production by the billion dollars. Higher metal prices combined with strongly sustained demand in domestic and foreign markets raised the total value of the Canadian mineral output in 1955 to more than \$1.7 billion compared with \$1.4 billion the previous year. Almost all divisions of Canadian mining are heading for still greater records in 1956. Yet recent developments suggest that, despite the spectacular progress of recent years, many of Canada's vast mineral resources are still largely untapped.

So far as over-production is concerned, there are sound reasons for believing that over a period the mining industry has nothing to fear. A fact not fully appreciated is the tremendous appetite which Western Europe is developing for durable consumer goods. Since the U.S. consumes roughly 50 per cent of the major metals available to the free world, the impact of European consumption on metal supplies and prices is likely to be increasingly felt. Finally, one can but speculate as to what may happen when the urge to demand such durable consumer goods as wireless sets, vacuum cleaners and motor cars descends on the so-called under-developed nations.

Consolidation of U.S. Labour

The final agreement to a merger reached in December between the American Federation of Labour (AFL) and the Congress of Industrial Organization (CIO) is described by our Western United States correspondent as "one of the important events of the year". The description can scarcely be considered an over-emphasis of the situation, as the merger places 15,000,000 workers in one body and embraces approximately one-fourth of the estimated 65,000,000 workers in the United States. At the moment the official designation of the new labour organization has not yet been decided upon, but with the obvious hitting power contained in so great a force of numbers clearly in mind, the Shakespearean adage, "What's in a name?" may be title enough for the time being.

Outside of the new organization, many of the remaining workers of the U.S. are unorganized, while others hold membership of unions that have not sought affiliation with either AFL or CIO. Notable among these are the railway workers, who function through a closely knit group of strong unions embracing the different phases of railway

operation. It is of interest that the United Mine Workers of America group formed the nucleus around which the CIO was built, despite the fact that United Mine Workers later withdrew and has since remained independent. A further brief glance at history brings the reminder that AFL dominated the American labour scene for more than half a century with the conventional trade union policy, and in 1935 CIO was organized by John L. Lewis, of United Mineworkers, on the "Vertical Union" plan. For many years there was keen and sometimes bitter rivalry between the two bodies, although with the passage of time the tension made place for the co-operation which led finally to the present "marriage".

The merger is a huge task, which will inevitably have its effects on industry, and it will be a long time before all the details and difficulties are adjusted. One outstanding problem will arise in cases where two unions, one AFL and the other CIO, have represented the workers in the same industry. Such a case is typified in the great lumber industry of the Northwest where the workers are represented by unions from both parent organizations, with about equal strength. It is hoped to solve such situations by mergers, but it is inevitable that problems will arise and rivalries be generated, which frequently bring an injury to the employer, an innocent bystander.

Indeed, a note of disharmony has already appeared. A former head official of CIO who is considered as the potential chief of the Industrial Union Department of the new union, recently stated flatly that the teamsters' union (AFL) would not be received into the Industrial Union Department of the new union. The teamsters have been the subject of much criticism, including charges of racketeering, and have signed agreements of mutual aid with Mine, Mill and Smelter Workers and International Longshoremen's Association, both of which have been expelled from the parent unions.

Offsetting this possible attitude on the part of the big union is a report that an attempt will be made to consolidate all unions outside the large organization. This move will be grouped about the Confederated Unions of America, an organization of local unions in varied industries, and could muster a possible membership of 2,500,000 which might afford an affiliation for Mine-Mill. A preliminary meeting has been held and a convention to discuss organization has been called for February.

The successful outcome of the merger is of interest to the mining industry, as it is expected that the big union will make a determined and systematic membership raid on Mine-Mill. The latter has been a thorn in the flesh of the operators for a long time and they would gladly see their workers allied with a more conservative organization. Raids have carried on in the past, principally by CIO's United Steelworkers, but Mine-Mill has pretty well held its own against them. The operators would prefer to see a non-ferrous metal workers department set up in the new union. Recently Mine-Mill has publicly modified its truculent attitude very noticeable and apparently is still hoping to be accepted into the merger but there is little likelihood of their success.

"Mining Miscellany"—New M.J. Feature

In this week's issue on page 55 we introduce a new feature to be known as "Mining Miscellany". As the title implies it will be composed of relevant items of mining information gathered from *The Mining Journal's* world-wide network of correspondents together with other information gleaned from our own very considerable news gathering facilities. It will feature mining developments, mining men in the news, coming events, and contracts and tenders.

Australia

(From Our Own Correspondent)

Melbourne, December 30.

Mount Isa Mines, the great Queensland lead-zinc and copper mining company, has reported that there are strong indications of the existence of large new copper orebodies, based on the evidence of exploratory diamond drilling and underground development. Exploratory and development work have proved very large tonnages of low grade silver-lead-zinc ore, the limits of which have not yet been determined. To work this ore occurrence large capital expenditure and mining at a greatly increased rate are essential.

MOUNT ISA'S BURDEN

Under existing conditions, with their consequent high cost of mining, milling and smelting, and at the present extraction rate, mining and treatment of this great reserve of low grade material would not be economic; its mining together with the higher grade reserves is essential if this national asset is not to be lost. Yet the Mount Isa Company receives scant recognition. It employs about 4,000 men, and supports a town of some 9,000 inhabitants in a remote and very sparsely settled part of Queensland. Its contribution to the railway revenue of the State is between £A1,250,000 and £A1,500,000; yet last year the enterprise was almost stopped by lack of rolling stock to move its products, and the granting of higher priorities to other classes of traffic on railway and wharves.

At the present time, a railway ban on overtime has reduced the mine coal stocks to a level that has compelled the cessation of both lead and copper smelting; employees have been transferred to other work for the time being; to stand men down would mean loss of large numbers of men, key men and others, and cause serious ultimate dislocation. Exports of lead and zinc last year comprised 58 per cent of the total metal exports, and could be increased if Government policies were designed to encourage production.

Taxation is another serious matter: all metals other than silver-lead-zinc receive a taxation exemption of 20 per cent. The company is making strong recommendations to the Federal Government that this exemption be granted to companies mining silver, lead and zinc. The extension of this exemption, enjoyed by all other non-ferrous metal producers, would be of substantial value in the working of large low grade ore occurrences and would encourage the working of small orebodies, which, under present conditions, are dormant.

REDUCED OUTPUT AT MOUNT LYLELL

Mount Lyell Mining and Railway Co. Ltd., Tasmania, has stated that because of delay caused by shortage of labour for driving a deep new approach adit through country rock to the open cut, to open up a new bench, ore production will be reduced in the current financial year. By 1957, the ore pass, through which some 25,000,000 tons of ore has been passed from the crusher station at the open cut to the tunnel below, for transport to the mill, will be worn out. To replace it, a new crusher station will be built, a new tunnel, 3,800 ft. long is to be driven, and a new ore pass system constructed.

The project will cost about £A325,000, but transport costs will be considerably reduced. Diamond drilling and other exploratory work within the Company's leases, has indicated enrichment and continuation of the main orebody under the open cut which could make substantial additions to the present 25 years mining programme.

Western United States

(From Our Own Correspondent)

Portland, Oregon, January 1.

Recent authorization by the Federal Power Commission of a tie in between two natural gas lines will assure a much increased supply of fuel and power to the Northwest, the only remaining large industrial district in the country without this commodity. One line is already well under construction from the San Juan field in New Mexico and Colorado to serve the area. The F.P.C. permit authorizes this line to extend to Sumas, Washington, on the international boundary line where it will join the line being built from the Peace River field in Canada and thus allow Canadian gas to be imported to augment the supply from the San Juan Basin.

Several mining areas will be benefited, including the Coeur d'Alene in Idaho and the zinc-lead district of north-eastern Washington, as well as the large aluminium plants in the vicinity of Spokane and Portland. Anaconda announced recently that it would build a plant for the manufacture of alumina from clays and that a site had been chosen in the vicinity of Spokane because of the availability of natural gas at that point.

The Industrial Commission of Utah has issued orders that commencing with the new year operators of uranium mines will be required periodically to monitor the content of radon and other radium derivatives in the air of their mines. The order, which also makes provision for adequate ventilation, is the result of studies which indicate that prolonged exposure to radon is injurious to health. It is expected that similar orders will be issued by other states in which uranium mining is being carried on.

PRIVATE ENTERPRISE IN LEAD ROLE

Eight companies have submitted proposals to A.E.C. to operate its various uranium ore buying stations after December 31. These have been operated by American Smelting and Refining Co. which has announced that it will not continue after the expiration of its contract on the above date.

Intensive development for uranium in the Colorado Plateau area has demonstrated the possibilities of this region as a source of other minerals as well. Several oil explorations are being carried on and Delhi-Taylor Oil Co., of Dallas, Texas, has acquired potash rights to 8,000 acres near Moab. Results so far indicate the probability of a deposit of such size as would justify a 3,000 ft. shaft with plant equipment totalling an investment in excess of \$10,000,000 but further development will be carried on to assure sufficient ore reserves to justify such an expenditure before plans are formulated definitely.

Climax Molybdenum Co. is adding a unit to its 30,000 ton mill which can be used in either of two ways. One will be to treat an additional 3,500 tons per day at the present recovery rate with the alternative of treating the present tonnage with an increased recovery of three per cent.

A situation, not entirely unexpected in view of the high prices paid by the Government to encourage the production of strategic minerals, has developed in connection with the purchase of tungsten ores. The evidence indicates that some considerable tonnage of the "domestic" ores purchased at \$63 per unit were in fact brought in from Mexico where they were acquired at the market price, currently \$33 per unit. A G.S.A. agent tracked down one "mine" that shipped several thousand tons and found only one surface excavation, and that of very limited dimensions.

High Temperature Metals and Alloys

The growing demand for materials capable of giving dependable performance during prolonged exposure to high temperatures is reflected by the recent formation in the U.S. of a new company to fabricate high-temperature metals, chiefly for the electronic, chemical and aircraft industries. The upward trend in the operating temperatures of steam and gas turbines also calls for improved materials which can stand up to these more exacting conditions. Some of the problems presented in the development of high-temperature metals and alloys are here reviewed.

Among the metals most likely to benefit marketwise from developments in the field of high temperature materials are chromium, nickel, cobalt, molybdenum, tungsten and vanadium, columbium and tantalum, and titanium.

Chromium is an essential ingredient of stainless steels and other high temperature alloys. Because of their strength, ductility and resistance to heat and corrosion, alloys containing high percentages of nickel are used in aircraft gas turbines and jet engines, as well as for the production of stainless steels. Cobalt base metal alloys will withstand 1,400 deg. of friction heat, which would be generated by aircraft travelling at 7,000 m.p.h. Because of its unusual resistance to high temperatures, molybdenum is of special importance for the hardening of steels used in jet engines. Both columbium and tantalum are important constituents of high temperature alloys. It is believed that the stainless steel industry alone could eventually take at least 2,000 tons of columbium a year, providing supplies at reasonable prices were assured. Because of its high strength-weight ratio, retention of strength at elevated temperatures, and corrosion resistance, titanium is particularly suitable for supersonic engine frames, engines and accessories, as well as for guided missiles and rockets. Aluminium is yet another metal which comes into the high temperature picture, while the field for metallurgical research is being further broadened by the special requirements of nuclear programmes.

CENTRES OF RESEARCH

Both the National Physical Laboratory and the Mechanical Engineering Research Laboratory are devoting much effort to fundamental studies of creep processes and of the fatigue strength of materials at high temperatures.

The overall efficiency of gas turbines increases progressively with the inlet temperature of the turbine. A few years ago the Parsons and Marine Engineering Turbine Research and Development Association (Pametrad) designed and built a long-life gas turbine of 3,500 s.h.p. at 85 r.p.m., which was designed for operation at 1,200 deg. F. At this temperature the efficiencies obtainable are of the order of 30 per cent. Pametrad is now actively engaged in the development of a gas turbine set to operate at 2,200 deg. F.

The development of cooled gas turbines may make it possible to use less expensive low alloy steels, which are easier to fabricate than the highly alloyed austenitic materials and which do not suffer from the disadvantages associated with the latter materials, notably a high coefficient of expansion and a low thermal conductivity. The development of porous austenitic stainless-steel (18/8) powder by an electrochemical disintegration method offers interesting possibilities for the production of porous gas turbine blades. From the initial experiments, however, it was concluded that the mechanical properties were probably only sufficient to withstand stresses of 3 and 4 tons/sq. in. at 842 deg. F., which is inadequate for rotor blades. Improved resistance to corrosion is also desirable, while another difficulty is that permeability decreases with time, probably due to partial blocking of the pores. Experiments have shown that the basic 18/8 powder can be improved by alloy additions.

Blade and disc materials for gas turbines are being studied

at the National Physical Laboratory. Tests have been started on a chromium-cobalt-tantalum alloy at 1,650 deg. F. Tests at the temperatures reached in gas turbine compressors have also been made on a titanium-rich alloy containing 4.5 per cent of aluminium. Excellent creep and fatigue properties at temperatures up to 750 deg. F. have been demonstrated.

PROBLEMS OF INCREASED STEAM TEMPERATURE

As a result of the successful development of the gas turbine, designers have realized that it is now practicable to raise the steam temperature in steam turbines to at least 1,200 deg. F. Two 100,000 kW. sets with steam conditions of 1,500 lb./sq. in. at 1,050 deg. F. are under construction for the British Electricity Authority. Turbines using steam at over 1,100 deg. F. already exist.

Here one of the most important problems is to find out at what temperature ferritic steels must be replaced by the more costly austenitic steels. The latter are certainly superior about 1,200 deg. F., but below 1,020 deg. F. they offer no advantage. Between these temperatures austenitic steel appears superior in short-term tests, but the possibility has been suggested that in the long run it might prove less satisfactory because of a tendency for the creep rate to increase progressively with time.

At the National Physical Laboratory consideration is being given to the metallurgical problems that will arise as steam temperatures are increased in steps to 1,200 deg. F. A programme of creep tests and metallographic studies at testing temperatures up to approximately 1,300 deg. F. is being carried out on steels containing six to eight per cent chromium, with additions of molybdenum, carbon and other elements, the aim being to assist the development in industry of the most economical steel having the necessary oxidation resistance and high temperature strength for use in superheated tubes at 1,110 deg. F. to 1,200 deg. F. The expected life of the steam power plants now under construction for operation at a steam temperature of 1,050 deg. F. is from 100,000 to 150,000 hours and in order to arrive at the working data creep and relaxation tests of up to 30,000 hours duration are being made. Dr. N. P. Allen has described tests in which the ferritic type was represented by 0.5 per cent Mo., 0.25 per cent V steel and the austenitic type by 18 per cent Cr, 12 per cent Ni, one per cent Nb steel. The comparison after 10,000 hours of testing was strongly in favour of the austenitic steel. No sign was found after 20,000 hours of increasing creep rates in this steel, where the stresses were of the magnitude that would be employed for superheater tubes and steam pipes.

In the steam field, corrosion, which has hitherto been of little importance, presents a serious obstacle in raising the temperature to over 1,100 deg. F. at the entrance to the turbines. Such operating conditions demand the use of steels of high chromium content—at least seven to nine per cent—whose creep resistance is low. Work at the National Physical Laboratory has shown that an important influence can be exerted by additions of titanium and columbium when the heat treatment is such that carbides dissolved in the metal at high temperatures are precipitated in highly dispersed forms at or near the working temperatures.

Opencast Mining at Nchanga, N. Rhodesia

An orebody estimated to contain nearly 90,000,000 tons of copper-bearing ore is to be exploited by opencast mining methods at Nchanga Consolidated Copper Mines Ltd., Northern Rhodesia. The following article gives a brief description of the operation, indicates why opencast practice has been decided upon rather than traditional underground mining methods, and describes the mining equipment currently known to be destined for duty in the Nchanga open pit.

During 1956, opencast mining operations will begin on an orebody estimated to contain nearly 90,000,000 tons of copper-bearing ore at Nchanga Consolidated Copper Mines Ltd., Northern Rhodesia. The excavation will measure 3,500 ft. in length and will be 800 ft. deep at its lowest point.

Before actual production can commence, some 7,000,000 to 8,000,000 tons of overburden must be removed, but preliminary operations already are well advanced and the orebody proper soon will be exposed at its nearest point. This immediate project will make available ore conservatively estimated at 33,000,000 tons. Yet in addition to this reserve of 33,000,000 tons, it is anticipated that the pit will have an appreciable extension to the east, where boreholes have indicated an extension of the ore that can be worked by opencast mining methods.

THE VOTE FOR OPENCAST

The policy of opencast mining has been adopted partly to cut down the disparity between the grade of ore currently being mined and the grade of total ore reserves. In other words, opencast exploitation will ensure against "over mining". A further reason for the decision in favour of the opencast method is that dilution from waste rock is expected to be negligible.

Considerations of labour requirements provide another excellent reason as to why opencast mining is, in this instance, preferred at Nchanga to the traditional underground operations of the Copperbelt. Indeed, if underground mining methods were attempted on the Nchanga orebody on the scale visualized, it is estimated that a labour force of some 220 Europeans and 1,800 Africans would be required. By using opencast methods a labour force of 40 Europeans and 400 Africans will be needed, and almost 100 per cent ore extraction will be achieved.

Finally, the capital cost of the new opencast venture will be approximately £2,500,000, and had traditional underground mining methods been employed, the cost of exploitation would have entailed additional expenditure of almost £900,000.

The new policy of opencast production will therefore



Bucyrus Erie 150-B unit operating in conjunction with side discharge wagon at Nchanga

mean that Nchanga, a property currently working one of the largest and richest copper deposits in the world, will exploit its holdings to the fullest extent.

Output in 1956 will exceed 150,000 tons of ore per month. Investigations have indicated that the open pit project will commence with a waste ore ratio of approximately 4:1. This will increase progressively as the pit grows deeper, and is expected to be in the region of 13:1 when 800 ft. depth is reached. At this stage it will probably be necessary to change over to underground operations, and by that time some 300,000,000 tons of waste and ore will have been removed.

SUMMARY OF EQUIPMENT

The main items of equipment used in the opencast operation will be, 6 cu. yd. capacity electrically-driven shovels for primary work and 1½ cu. yd. diesel shovels for auxiliary work. Diesel and diesel-electric railway units pulling trains of eight side-discharge wagons, each of 28 cu. yd. capacity will be used as the main waste disposal equipment, operating on 81 lb. track over a maximum distance of two miles from the centre of gravity of the pit to the waste disposal site.

Two types of vehicles will be used for the handling of ore and minor amounts of waste, namely 22-ton end-discharge trucks and a 34-ton side-tipping trailer used in conjunction with a tractor. Bulldozing and road-grading equipment will be of the conventional type, with caterpillar tracks for bulldozers and standard pneumatic tyres for road graders.

Owing to the unknown nature of the ground, it is not yet known what type of drilling equipment will be used. It is anticipated, however, that the waste material to be mined is so decomposed and weak that little actual mining will be necessary. Percussion drills are likely to be used on the orebody, with 6 in. dia. holes spaced at intervals.

The pit will be arranged in a series of steps approximately 50 ft. high and 100 ft. wide, and these will be connected by a series of incline roadways to facilitate hauling.



Bucyrus Erie 150-B excavator in Nchanga open pit

Nuclear Energy Needs of O.E.E.C. Countries

On June 10, 1955, a Working Party was set up by the Council of the O.E.E.C. to examine and report on the possible scope, form and methods of economic and financial co-operation within the Organization in order to secure the greatest benefits from the peaceful use of nuclear energy. The Working Party has published a report, "Possibilities of Action in the Field of Nuclear Energy", in which the basic principles of nuclear energy production are very simply explained.

In the not distant future nuclear energy will be essential in many countries. Even those which still have large untapped sources of hydro power are, without exception, obliged to consider seriously how electric power can continue to expand after all economically justified hydro installations have been put into service. This point will be reached within about ten years in France, Italy, Switzerland, Sweden and Portugal, twenty years in Sweden, and a little later in Norway and Austria. The question of power is even more urgent in countries producing electricity mainly from coal. Even in Germany, a traditional coal exporter, the use of nuclear energy for generating electrical power is envisaged in the relatively near future.

It is believed that the costs for nuclear energy are at present comparable with those of the conventional forms of energy, but should fall in the coming years. It would be a mistake, however, to expect these costs to fall low enough for nuclear energy to supersede other forms of energy.

THE NUCLEAR FUELS

The activities of the Working Party cover two technical fields: (a) setting up means of production for nuclear energy; and (b) production and use of specific by-products (radio isotopes and secondary nuclear fuels).

Taken from the energy point of view, a nuclear reactor can be considered as a special type of boiler, which can be used for raising low pressure steam, propelling a ship, and, especially, for driving turbo-alternator sets. To continue the analogy with the conventional boiler, the nuclear fuel is a term which embraces two very different types, i.e., fissile and fertile. The "fissile" materials can be used directly to produce nuclear energy; they constitute the actual fuel for the reactor and, if sufficiently pure, the explosive for the atomic bomb.

Certain types of reactor require the use of very special auxiliary materials such as heavy water, highly purified graphite, beryllium and beryllium oxide, zirconium, helium, etc.

Of the only three "fissile materials" which can be used in practice, uranium 235 is a constituent of natural uranium; plutonium and uranium 233 are materials which do not exist in the natural state but can be produced in reactors.

The "fertile" materials are potential nuclear fuels. Although incapable of emitting nuclear energy directly in a bomb or in a reactor, these elements gradually undergo a partial transformation into the fissile type if introduced into a working reactor. Only two "fertile" substances are known to exist: Uranium 238 (by far the most plentiful constituent of natural uranium) and thorium 232, the only constituent of natural thorium. In a reactor, uranium 238 is transformed into plutonium (Pu) and thorium 232 into uranium 233.

Although the primary role of nuclear reactors will be to generate energy for industrial use, it would be unreasonable not to take advantage also of the facilities they offer for converting "fertile" into "fissionable" materials. This explains why, apart from very compact consumer reactors of the type used to propel submarines (which are run almost entirely on fissile fuel), most industrial reactors are

of the converter type, the fuel being a mixture of fissile and fertile materials (frequently not more than one-two per cent fissile). Some converter types have the property of producing more fissile material than they consume, but at the present stage of technique, breeders are more difficult to build than other types of reactors.

SEQUENCE OF ORE CONCENTRATION

The first step to be taken by countries wishing to develop a nuclear industry is to prospect for natural uranium and thorium. Except in a few cases (e.g., the Belgian Congo), the ore is found in a very weak concentration and requires to be concentrated either mechanically or chemically on leaving the mine. The high concentrates are not bulky and can easily be transported to a plant for chemical concentration to a high degree and conversion into oxides or other chemical compounds.

Either physical or chemical methods of concentration can be applied, according to the type of ore involved. In physical concentration the ore is crushed and separated from the gangue by: (1) gravity, whether on a vibrator or by mixing with a magnetite wash; (2) flotation with added non-wetting agents; (3) selecting batches of ore according to their radioactivity. These processes are not normally expensive, but neither are they uniformly effective.

All chemical concentration processes can be summarized as follows: (1) dissolving the uranium selectively out of the gangue; and (2) recovering the uranium by removing it from the solution. Though easy, the first step is expensive, since it consumes large quantities of auxiliary materials (i.e., acids). The difficulty of the second step lies in the fact that the solutions to which the process is applied are highly diluted; on the other hand, this process is highly efficient.

The two methods can sometimes be combined by concentrating the ore through some physical process at the mine so as to raise the metal content a few per cent, and then sending the resulting product to a chemical concentration plant.

PRODUCTION OF METALLIC URANIUM

When delivered at a metal producing plant, the concentrates have a uranium content of at least 30 per cent. They are then subjected to various kinds of treatment, the three essential ones being as follows: (1) redissolution in acid, followed by the production of a highly purified uranium salt (frequently a nitrate); (2) chemical processing of this salt to produce uranium tetrafluoride; (3) sharp thermal reaction of the uranium tetrafluoride with calcium or magnesium. The calcium or magnesium is thus converted into fluoride and metallic uranium is obtained.

The construction of a plant producing 500 tons of uranium metal a year is estimated at approximately \$4,300,000 and such a plant would consume roughly \$2,300,000 worth of auxiliary products a year, but relatively little power. It is not unreasonable to estimate that, in Europe, the cost of converting concentrates into metal would amount to about \$8.5 per kilo of uranium.

Chemical compounds of natural uranium can be used immediately for the generation of nuclear energy, since

they contain fissile uranium 235. On the other hand, those of natural thorium can only be used after treatment in a uranium reactor. The former compounds can be transformed into metallic natural uranium, which is alloyed with other metals, machined and canned (i.e., it is made up into fuel elements ready for service in natural uranium reactors). A disadvantage of this method is that natural uranium contains a fixed proportion of fissile in relation to fertile materials (1/140 U 235) and this very considerably restricts the choice of design for reactors using it.

ENRICHMENT OF URANIUM

To mitigate this restriction in technical design, uranium can be enriched in U 235, in installations known as isotope separation plants, which are extremely costly to build and run. The process most generally used is that in which the isotopes are separated by gaseous diffusion in a so-called diffusion plant. Uranium is first converted from the oxide into the hexafluoride, which vaporizes at about 50 deg. C. and is introduced into the plant as a gas. The enrichment is achieved by diffusion through special membranes which allow U 235 F₆ to pass through a little more easily than U 238 F₆. The degree of enrichment can vary according to the design of the plant from a little over the natural proportion to almost pure U 235.

Although irradiated fuel, which has been in a reactor for some time, is extremely dangerous on account of its high radioactivity, it can be treated chemically and separated into four fractions: (a) primary fuel, with its content of fissile material reduced; (b) useful radio isotopes:

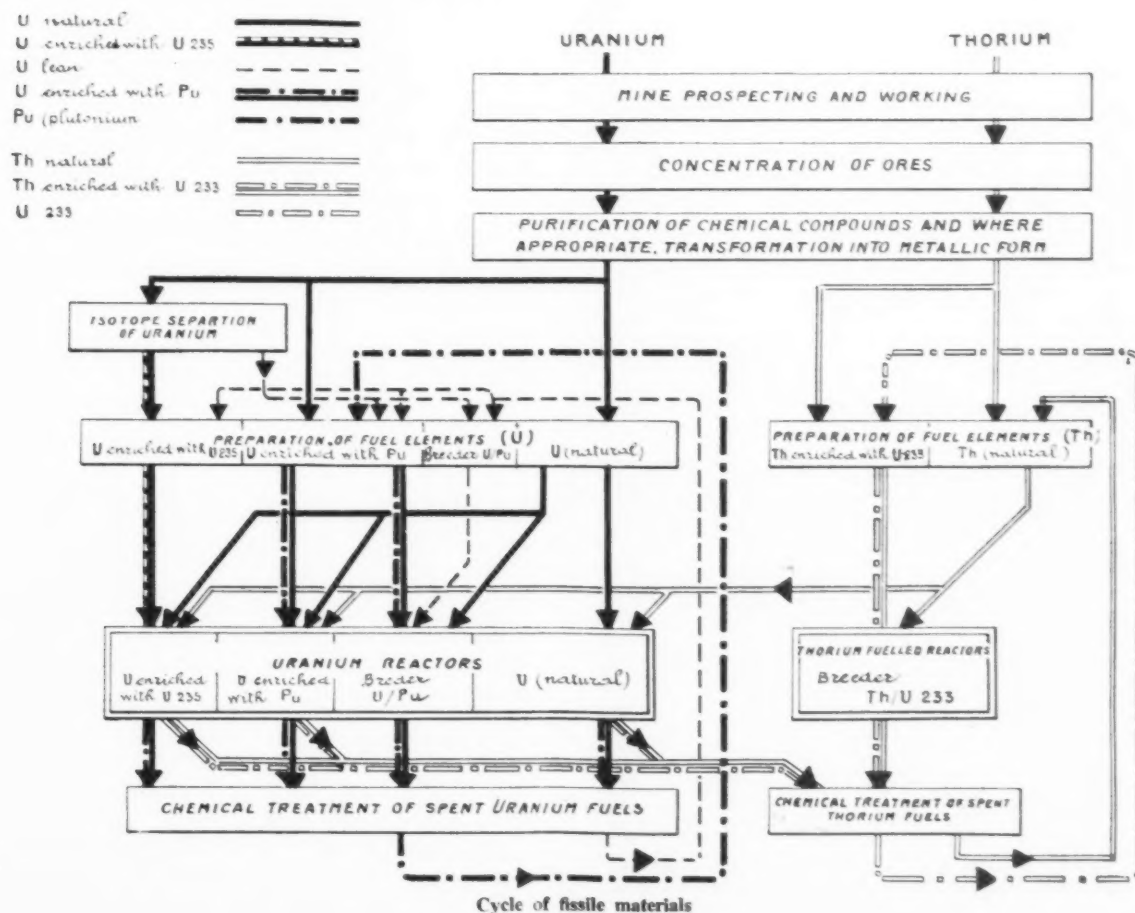
(c) radioactive waste (equivalent to the ash of conventional fuels); and (d) almost pure converted secondary fuel (plutonium or U 233).

A plant to handle 500 tons of irradiated uranium a year would cost roughly \$40,000,000.

As soon as a sufficient quantity of secondary fuel is available (i.e., uranium enriched in U 235 by diffusion, or plutonium or U 233 obtained in the first reactors), it becomes possible to embark on an extremely varied nuclear programme by mixing fissile and fertile materials as desired. In particular, it will be possible to use almost all the available fertile materials in breeder reactors (U 238 plus plutonium or thorium plus U 233) as soon as a suitable industrial technique has been devised. Some, but not all, of the possibilities are shown below.

The development of a European nuclear energy industry requires a considerable effort as regards equipment, technicians and expenditure. So far it is apparent that Europe, taken as a whole, is very under-equipped as regards nuclear energy. European expenditure on nuclear energy in 1955 amounted to about \$300,000,000, as against \$2,000,000,000 by the U.S. in 1954. The latter figure includes expenditure for military purposes but does not include independent industrial effort.

The Working Party is of the opinion, however, that if Europe is willing to make the necessary effort, and provided that it can secure adequate access to fissile materials, the leeway can be made up and a large nuclear energy industry can be developed, but the only chance of success is to act as quickly and as effectively as possible.



Development of Zirconium Technology

Developments in zirconium technology were reviewed in *The Mining Journal* of February 6, 1953, but progress since that time has been extremely rapid both technologically and in the expansion of production facilities. The following article describes those properties of zirconium which promote its role in nuclear development.

Zirconium has several properties which make it an outstanding material for thermal reactors. Though almost as strong as steel it is much lighter, its resistance to corrosion is excellent, and it has the extremely high melting point of 3,350 deg. F. Finally, it does not absorb and thus waste neutrons needed to sustain a chain reaction. This combination of desirable properties renders the metal an ideal structural material not only for reactors in nuclear power stations but also for atomic submarines and, presumably, atomic aeroplanes.

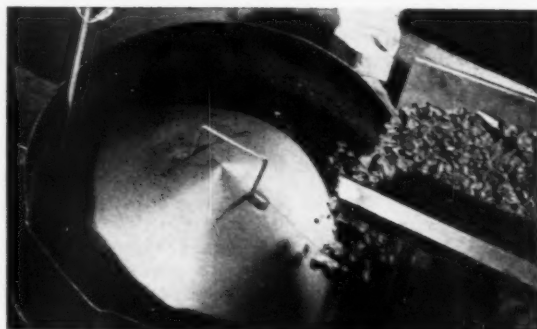
Before nuclear technologists discovered its low neutron cross-section, ductile zirconium was a rare metal, produced in small quantities by the iodide process, and its selling price was \$300 per lb. To-day, reactor-grade sponge metal sells for only about \$14 per lb.

All zirconium ores contain small quantities of hafnium, which resembles zirconium in its general properties but has a thermal neutron absorption cross-section over 600 times as great. For nuclear applications the hafnium content of zirconium metal must therefore be as low as possible. Reactor grade metal contains less than 0.01 per cent hafnium. For most commercial applications, however, a small percentage of the latter element is not detrimental, so a commercial grade containing 2-2.5 per cent hafnium is also being produced.

USE OF KROLL PROCESS

Nowadays zirconium metal is produced mainly by the Kroll process, originally developed for titanium metal, which has been adapted by Dr. W. J. Kroll and his co-workers at the U.S. Bureau of Mines. In this process zircon sands are treated in an electric furnace to produce carbide, which is processed into anhydrous zirconium tetrachloride. Sponge metal is obtained by the magnesium reduction of the tetrachloride.

Besides adapting the Kroll process for volume output of zirconium sponge, the U.S. Bureau of Mines has developed a consumable-electrode arc-melting process which avoids contamination in melting the sponge into ingots of usable form. At Firth Sterling's plant at Trafford (Pa.), the sponge is pressed into compacts 2 in. sq. by 20 in. long weighing



Zirconium sponge being poured into large deposition tank at the American Westinghouse Atomic Power Division as first step in process that produced 99.9 per cent pure zirconium metal

15 lb. each. By means of a double melting process the compacts are transformed into 600 lb. ingots of homogeneous composition. In the first melting furnace the compacted sponge is melted under an argon-helium gas mixture in a water-cooled copper crucible. The resulting ingot weighs approximately 310 lb. In the second melting under vacuum two ingots joined together form the electrode and are melted at the rate of 13 lb. per min. The resultant ingot is 12 in. in dia. and weighs 600 lb.

By 1948, when the A.E.C. became interested in zirconium, the U.S. Bureau of Mines had a pilot plant in operation, which was capable of producing about 3,000 lb. of sponge metal a year. This plant was later enlarged to the point where more than 280,000 lb. of zirconium sponge was produced in a single year. Private industry began producing zirconium and hafnium by the Kroll process in 1953. With assistance from Bureau experts, it was able to increase its capacity for both metals so rapidly that by last May the Bureau was able to put its own production plant in standby condition and concentrate on specific problems which, so far, have limited the use of these metals and their alloys. At the Atoms for Peace Conference last year, it was stated that the U.S. produced 5,000 tons of zirconium in 1954 and expected to produce 30,000 tons in 1955.

THE PICTURE IN EUROPE

When Murex Ltd. considered the production of zirconium at their works at Rainham, Essex, they chose the Kroll process as the basis for their investigation and built a plant on similar lines to the original plant at Albany. Zirconium metal is also being produced in France.

The U.S. Bureau of Mines hopes to improve production techniques further by learning more about zirconium's properties and developing better melting and casting methods. A liberal exchange of information between the Bureau and American industry will ensure that new developments are rapidly translated into commercial practice. Much research on zirconium is also being undertaken in the United Kingdom. Zirconium now appears to have reached the stage when its early teething troubles have been overcome and it can be regarded as an established material.



Furnaces wherein the zirconium deposition process was begun at American Westinghouse. The aisle was designed, equipped and put into production in 14 weeks

Recent Canadian Mining Progress



Open pit iron-ore mine at Marmora, Ontario, showing crushing and pelletizing plants and magnetic concentrator to process low-grade magnetite

With a steadily rising world demand for steel, Canada's potentialities as a producer of iron ore are growing in importance. Within 10 to 20 years, it is reliably estimated, the country's known major deposits will be providing between 30,000,000 and 40,000,000 tons of ore.

Northern Ontario's Steep Rock Mines, where engineers diverted a river and drained off billions of gallons of water, are now yielding 2,250,000 tons of ore a year. On Newfoundland's Bell Island, from submarine shafts extending three to four miles out under the Atlantic Ocean, 2,500,000 tons of ore are flowing annually to supply the steel industry at Sydney, Nova Scotia, and to fill orders from the United Kingdom and Germany. Indeed, total Canadian iron ore output in 1955 is expected to reach some 14,000,000 to 15,000,000 tons, and the value of iron ore exports may exceed \$90,000,000 (\$35,000,000 in 1954).

In New Brunswick, rich deposits of zinc, lead and copper have been located at Bathurst and Newcastle. Reserves are over 50,000,000 tons, and mining companies will spend some \$25,000,000 to bring their properties to production.

In Quebec Province, fresh copper operations, with a capacity of 6,500 tons of ore a day, have helped open up the dead heart of the Gaspé Peninsula. Over \$40,000,000 have been spent on exploration and mill construction.

Canada, producer of about 80 per cent of the world's



Pithead and secondary plant at Wabana Mines, Bell Island, Newfoundland. The workings extend three miles below the sea bed

nickel, possesses a big new mine at Lynn Lake, Manitoba. To bring this into production, Sherritt Gordon Mines Ltd. moved all usable mining machinery and equipment from its worked-out mine at the town of Sherridon.

Atomic energy has brought in its train a number of new "miracle" metals. Uranium has become a top prize and considerable finds have been made at Beaverlodge in Northern Saskatchewan and near Blind River, Ontario. With known deposits at Great Bear Lake in the Northwest Territories, these discoveries assure for Canada a leading position in world uranium output second to the Belgian Congo. It is estimated that by the end of 1957 Canadian uranium production will have a gross value of \$100,000,000, about 12 times as great as at the end of World War II.

Topping Canada's mineral production, crude oil output totals 95,000,000 bbl. a year, with a value in 1954 of \$246,000,000. The value of Canadian crude oil exports for 1955 should be at least \$35,000,000 (\$6,000,000 in 1954).

In all phases of the mining industry, improvements in processing methods are continually making rich finds of deposits that, in earlier days, might have been written off as of little or no economic interest. Canadian mineral production is growing in the quantity and value of individual minerals and in the form of new materials.



Four pumps of 1,000 g.p.m. capacity, handle water disposal at Errington No. 1 Mine, Steep Rock, Ontario.



Algoma's Helen and Victoria Mines, Ontario. Low-grade siderite was first produced opencast, then underground

The World Coal Mining Industry

In the following article our Coal Correspondent presents a summary of the current situation of the world coal mining industry, and in so doing, offers the inevitable conclusion that American output has increased despite a reduced labour force while simultaneously output in Europe lags and the economic deficit of the British industry remains serious.

In the U.S. the coal industry seems set fair for a bumper year—in startling contrast to the situation a year ago. At this time last year output was down to less than 400,000,000 tons in comparison to a normal annual output of 450,000,000 tons. Many mines were operating a three-day week and indeed, so bad was the situation in parts of Pennsylvania and West Virginia that these fields were designated "special areas" to which the Government should preferentially direct its contracts. However, this year has seen a tremendous upsurge of demand—both home and foreign—and the industry as a whole has regained stability. Production of coal is almost certain to reach the 450,000,000 tons mark by the end of the year.

DEMAND IN THE U.S.

It is expected that the current demand for American coal will continue at least well into next year and indeed many operators are predicting full order books for the next five years. There seems to be every reason for optimism. Internally the steel industry is consuming 25 per cent more coal than of recent years and sales to the electric utilities are up by 18 per cent. The threat to coal markets of oil and natural gas seems to have receded. Demand for oil and gas is considered to be taxing available supply so that future increases in energy requirements will be met by coal.

It says much for U.S. production methods that the increase in output this year has been gained with a smaller labour force. The total number of men employed in the bituminous and anthracite fields is now approximately 240,000; almost 30,000 less than last year.

Even allowing for the fact that the men now employed are working more shifts per week the increase in O.M.S. is still commendable. Productivity in the bituminous mines is just on 10 tons per manshift—a rise of two tons in three years. This is partly due to the increasing use of bigger and better power loaders together with mergers within the industry which have had the effect of establishing larger combines capable of closing inefficient mines.

Currently the U.S. is exporting at the rate of 40,000,000 tons per year of which 22,000,000 tons is destined for European ports. Italy, West Germany, U.K. and Netherlands are at the moment the principal importers, although if Britain does, in fact, cease to export coal the picture will change.

EUROPEAN SITUATION

Faced with lagging coal production and energy consumption rising some two per cent each year the High Authority of the European Coal and Steel Community is expected to declare an official shortage of coal. Such a declaration by the High Authority would empower it to set up an allocation scheme and control of exports to countries outside the Community. The reasons behind the projected move are bound up with the decision of the U.K. to drastically cut coal exports to Europe.

At the moment the Pool's coal exports to Britain are only slightly more than imports from the U.K. However, a cut of several million tons in the exports from Britain to Europe—whether community or non-community countries—will radically alter the situation. For instance, such

countries as Spain and Portugal will have to seek fresh suppliers. To whom can they turn? American coal is available but the price is too high. Consequently they will turn to the Pool countries. As things stand, coal producers inside the Pool are not obliged to sell preferentially inside the Community and any inflated bids for Pool coal from outside countries—if accepted—would seriously aggravate the existing shortage within the Community. On the other hand unco-ordinated bidding for American coal might lead to spiralling freight charges, so increasing the already heavy financial burden to the Community occasioned by high cost American coal.

Consequently the Community will no doubt endeavour at the present series of meetings of the Anglo-European Coal Committee to persuade Britain to reverse its decision to cut exports. Failing in this attempt the High Authority will have little choice in the matter but to declare an official coal shortage within the Community, unpopular though this move will prove to be.

PROFITABLE OPENCAST MINING IN U.K.

The Quarterly Statistical Statement issued by the National Coal Board covering the months July, August and September reveals a deficit of £5,000,000. The third quarter usually yields the worst results of the year owing to the incidence of miners' holidays but a loss of £5,000,000 comes somewhat as a relief after the £19,000,000 deficit of the previous quarter. Losses on imported coal accounted for no less than £8,500,000 during the quarter. A bright feature of the statistical statement is the fact that opencast working showed a profit of almost 11s. per ton. Although this profit is revealed as being largely due to the higher prices charged generally for coal during the quarter, the working costs of opencast mining have shown little change over the last four years despite rising wages. It is clear that opencast mining in the U.K. is now on a soundly profitable basis.

The falling output from the collieries is still giving concern and a Government spokesman in the Commons recently detailed causes of lost output as being: 1,400,000 tons due to strikes; 900,000 tons to lower productivity; 700,000 tons increased absenteeism; 200,000 tons reduced overtime working; 700,000 tons falling manpower.

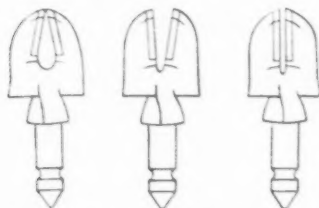
FAR EASTERN DEVELOPMENTS

India's proposed second Five-Year Plan for coal (*Mining Journal*, November 18) came under heavy fire at the Indian Coal Conference held recently in New Delhi. Cause of the bother was the point blank refusal by the Government to give the owners of the private mines an assurance that their mines would not be nationalized during the five year period 1956-61. The plan envisages private mines stepping up production from the present 34,000,000 tons per year to 42,000,000 tons whilst state mines increase output from 3,000,000 tons to 18,000,000. Not unnaturally the coal owners want to know where they stand before committing capital to expansion and mechanization schemes. The conference ended in failure and the participants were dismissed after being asked to submit plans for increasing production within the next two months.

MACHINERY AND EQUIPMENT

Design of Drill Bits

The four main considerations which enter into the design of a drilling bit are the tungsten tip, the steel body, the tip fixture and body contour. These are dealt with at some length in *Technical Bulletin No. 15*, published by Victor Products (Wallsend) Ltd.



Bit design, left to right, Positive rake, negative rake and offset neutral rake. The latter is Victor standard

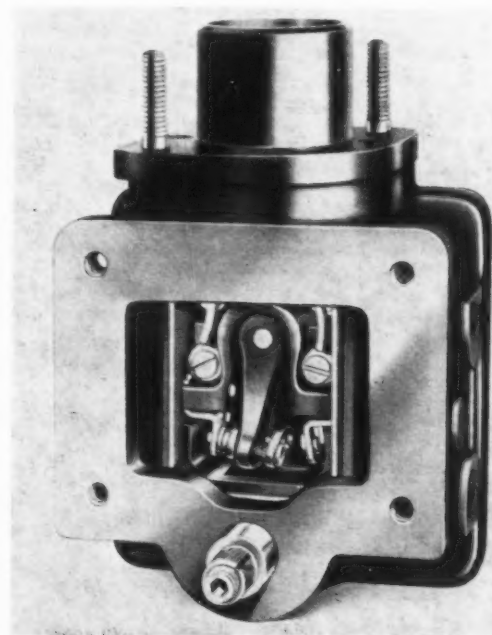
The performance of a drilling bit is two-fold; namely to obtain the maximum footage drilled per bit with the minimum of effort on the part of the operator. It is possible to obtain a bit with maximum footage at the expense of effort or, alternatively, a bit requiring a minimum of effort

but which does not give an overall footage. The choice lies between the slope and angle of the tip and the grade of tungsten.

A bit designed in positive rake will make drilling easy for the operator but will be subject to fracture on all but the softest material, while the negative rake will eliminate fractures but the effort required is markedly increased. A neutral rake will meet all average requirements, but a modification to standard design and covered by Victor patent is available. This type A.S. bit with sloping internal angle for soft material increases the speed of drilling by approximately 14 per cent with the same effort.

A Snap-Lock Flameproof Limit Switch

Following the great success of the Standard 16D-1200 range of Snap-Lock Limit Switches introduced in 1953 by Burton, Griffiths and Co., Ltd., a flameproof version has been



B.S.A. Acme snap-lock flameproof limit switch with front cover removed

designed by the same manufacturers to comply with the requirements of BSS 229 and 587. For some time, a number of these switches have been used in collieries. The mechanism of the new switch is identical with that of the Standard Snap-Lock design.

Although for colliery work the only protection required is against Class I gases such as Methane, the superior workmanship embodied in the flameproof Snap-Lock switch ensures its safety against Class II and III gases. The switch has passed the appropriate tests of the Ministry of Fuel and Power at the Buxton testing station and is licensed to carry the Ministry's official FLP mark.

The flameproof switch is a single phase, or D.C. double circuit, or two-way switch having one normally closed and one normally open circuit, which can be reversed by moving the return spring to the side required. To comply with the N.C.B.'s directive that no aluminium die casting may be used in dangerous locations, the switch is housed in meehanite iron castings. The Snap-Lock unit is mounted in the main body and removal of the front plate exposes the electrical side for examination. The switch is operated by a $10\frac{1}{2}$ deg. movement of the operating lever which has an effective length of $1\frac{1}{4}$ in. The surfaces of the cast iron parts are Parkerised finished and coated with P.41 pyrene lacquer, and other bright parts are heavily plated with cadmium.

Chalk Quarrying by Diesel Crawler Tractor

At the Alpha Cement Works, Sussex, a successful experiment has been in progress in which it was shown that the use of diesel crawler tractors in chalk quarrying achieved a marked reduction in costs from other methods of excavation such as



Challenger 4 diesel crawler tractor with Bray direct acting hydraulic angle dozer at the Alpha Cement Quarry

blasting or benching. In Britain, where the usual method of chalk excavation is by face shovel or dragline, blasting is often unsuccessful due to the cushioning effect on the charge.

Some time ago at the Alpha quarry, it was decided to prove that crawlers would be more effective than excavators, and a 95 b.h.p. Fowler Challenger 3 diesel crawler tractor equipped with a Bray hydraulic angle dozer was put to work. The tractor worked on the hardest part of the face, cutting grooves at right-angles to the cliff. The grooves were about 20 ft. long and the spoil was pushed over the cliff onto the quarry floor 100 ft. below where it was collected and removed by excavator and dump truck.

Some 6,600 tons of middle and bottom chalk were removed from the face in 11 days by the Challenger 3, and 2,500 tons were removed in the last two days of the trial, these two days being of 8 hour working excluding maintenance and lunch time. Recently Alpha Cement bought a Challenger 4 which during initial tests removed 160 tons per hour. Now, after some experience with the new machine approximately 200 tons per

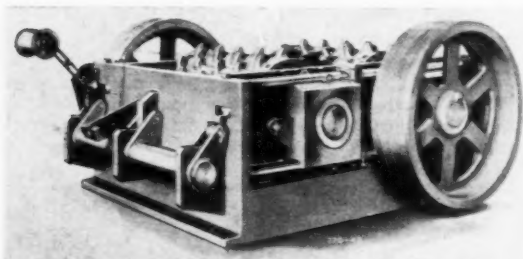
hour are being excavated. The Challenger 4 Diesel Crawler Tractor is powered by a Meadows diesel engine developing 150 b.h.p., and is manufactured by John Fowler & Co. (Leeds) Ltd.

New Range of Double Roll Crushers

An addition to the B.J-D range of crushers was recently announced by British Jeffrey-Diamond Ltd. Designated the Double Roll Crusher, the machine was inspected at Wakefield by a representative of *The Mining Journal* who saw the first production model, a 48 in. by 60 in. machine for very heavy duty, completed and ready for export to the Central Provinces Manganese Ore company's plant at South Tirodi, Madhya Pradesh, India.

In this particular application, the machine will be used for crushing rock overburden and, handling feed sizes up to 48 in. by 36 in. by 24 in. It will give a product of 8 in. to 10 in. and below at an output of 150 tons per hour. Two motors, each of 150 h.p. will drive two rolls, one at 157 r.p.m. and the other at 80 r.p.m., the speeds being governed by the sticky nature of the material.

The British Jeffrey-Diamond Double Roll Crusher is manufactured in four sizes, namely 30 in. by 36 in.; 30 in. by 48 in.; 42 in. by 48 in. and 48 in. by 60 in. In all these dimensions the former denotes diameter and the latter the width of the roll. There are certain differences in design between the smaller and larger models.



A prototype, with top covers removed, of the heavy duty B.J-D Double Roll Crusher

Constructional details reveal that the large diameter shafts are equipped with heavy bronze bearings with motorized forced grease lubrication. Drive is by V-belt. Adjustment of the movable roll gives a variation ranging from 4 in. to 16 in., and it is thus possible to vary the size of the product from a maximum of 12 in. down to 2 in. Protection is by shear pin on the larger models and by relief springs on the smaller, while in addition the segments are of manganese steel, bolted and keyed, making for easy replacement.

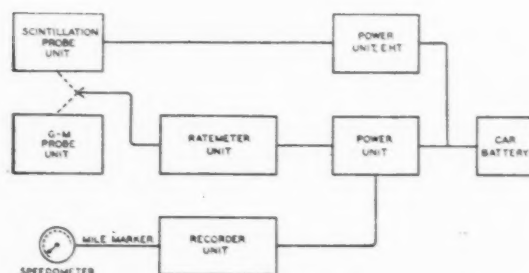
Roll speeds range from 150 r.p.m. and 125 r.p.m. for the two larger models respectively to 115 r.p.m. for the two smaller. Indeed, it is stated that the large crushers are capable of handling the entire output of a mine without picking or sizing. It is further claimed that flats and slabs are eliminated.

Although the usual applications of the B.J-D Double Roll Crushers will be the treatment of coal, rock, shales and similar structure solids, the machines are presented as being suitable also for the crushing of ores and any large, friable feeds.

Car-Borne Counter for Radiometric Surveying

Robust Geiger-Muller and scintillation counters with cold cathode valve circuits, specially designed for car-borne use, have been employed by the Atomic Energy Division of the Geological Survey since 1950. The equipment, which is particularly suited for installation in a Land Rover, is operated from the car's battery and is provided with audible alarm, ratemeter and continuous recording mechanisms. The equipment, and its installation in the Land Rover, are described in *Bulletin No. 10*, of the Geological Survey of Great Britain.

A recommendation proposing the construction of the equip-



Diagrammatic disposition of components

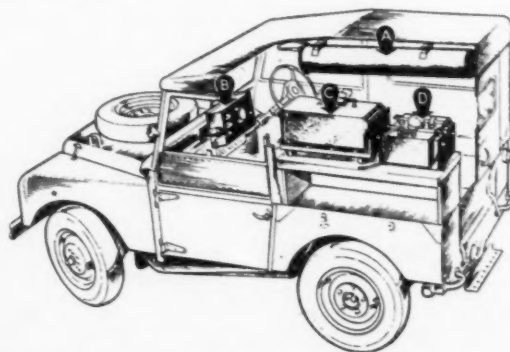
ment was submitted by the Atomic Energy Division, Geological Survey, to the Ministry of Supply. The sensitivity recommended was such that the average level of background radiation would be shown by one-fifth of the full-scale reading on a non-linear ratemeter, the full reading corresponding to 0.04 per cent of U_3O_8 in bedrock assuming a source effectively of infinite area. An audible alarm designed to operate at one of four pre-selected levels of gamma ray intensity corresponding to 0.005, 0.02 and 0.04 per cent of U_3O_8 was also to be incorporated.

The general layout of the equipment is illustrated above. The components represented along the centre line of the diagram namely the Geiger-Muller tube, ratemeter and power units, form the basic instrument for routine work. The scintillation probe with its auxiliary power unit, and the recorder unit coupled to the vehicle's speedometer, are intended for use during more detailed radiometric surveying. The components of the Geiger-Muller equipment complete with recorder are illustrated as installed in a Land Rover. The ratemeter unit, carrying all the operational controls and a micrometer to show the level of radioactivity, are fixed within easy reach of personnel.

In brief description, the probe unit contains a bundle of six large Geiger-Muller tubes carrying chrome-iron cathodes 63 cm. long by 3.4 cm. dia. They are filled with a neon-argon-bromine mixture giving a Geiger-Muller threshold in the neighbourhood of 360 v. The tubes are normally operated in parallel.

The ratemeter unit houses the remainder of the ratemeter components and the alarm circuit, while the power unit is designed to operate from a 12 v. car battery by way of a motor generator supplying a nominal 530 v. at 40 milliamperes. The supply is tapped at 210 v. and 315 v. by the introduction of three 105 v. stabilizer tubes connected in series.

Various types of recorders can be used with the equipment, the scintillation probe unit is interchangeable with the Geiger-Muller probe unit and contains a similar cold cathode trigger valve directly operated from a photomultiplier tube, and the voltage necessary to operate the photomultiplier tube on the plateau region is between 1,500 v. and 2,000 v. This is supplied from the 12 v. primary source by a non-synchronous vibrator and transformer feeding a metal rectifier voltage doubler system to produce approximately 2,600 v.



Typical installation in a Land Rover, showing (a) probe unit, (b) ratemeter unit, (c) recorder unit and (d) power unit

MINING MISCELLANY

It has been reported from Sierra Leone that Mr. Philip Oppenheimer, a director of De Beers Consolidated Mines, will be chairman of a new company which is to be founded for buying diamonds from licensed African diggers. A Bill to ratify a new diamond agreement with the Sierra Leone Selection Trust is expected to be passed through the Legislative Council this month and licences will then be granted to Africans. The new company will be in a position to start buying early in February.

Enquiries into the proposed £150,000,000 sterling Volta river hydro-electric scheme for the Gold Coast are now complete. The Commission set up to investigate the possibilities of the scheme is drawing up its reports, which will be presented to the British and Gold Coast Governments. It is expected that the reports will be published in about four months. The project comprises the building of a dam and power station about 50 miles inland, which would create the largest artificial lake in the world, covering an area of 2,300 square miles. The undertaking would provide power for the mining of bauxite deposits estimated at 168,000,000 tons in one part. An aluminium smelter would be built.

Mexico's iron ore reserves, mainly haematite, were recently estimated at 500,000,000 tons, while known reserves of coking coal were given as 2,000,000,000 tons. Changes in Mexican mining law to make it possible to work these reserves, and also deposits of manganese, etc., on an economic basis were asked for at the First Mexican National Iron and Steel Congress held at Monterrey from October 23-26 last year.

It is anticipated that a full report will be available in 1957 of the mineral resources of Swaziland, states *The South African Mining and Engineering Journal*, and that mineral rights on Crown land will be issued by the Resident Commissioner. In the Bonvu Ridge area there is high grade haematite iron, 65 per cent, with $\frac{3}{4}$ per cent silica content, the deposit being estimated at 40,000,000/50,000,000 tons, while the coal area is eighty by four miles. Tin and other metals are also present, while Havelock is already one of the largest asbestos propositions in the world.

The Soviet Government has given back to Bulgaria her share in the joint mining company "Gorubso". The papers said the agreement which was signed in Sofia on November 26 provided for the repayment to the Soviet Union of the value of her share in the joint company "on favourable terms over a number of years". The Gorubso joint Bulgarian-Russian mining company was responsible for the mining of brown and hard coal, copper, iron ore, lead, zinc, chrome, manganese and oil. It was the most important of all the joint Soviet-Bulgarian companies set up to exploit the natural wealth of Bulgaria after the war. Most of the other companies were sold back to Bulgaria in October, 1954. It was believed here that the mining of Bulgarian uranium ores, which was kept strictly secret, was carried on by another joint company of which the Russians still retained control.

PERSONAL

Paul T. Allsman has been appointed chief mining engineer of the U.S. Bureau of Mines.

Messrs. P. H. Anderson and W. M. Frames have resigned from the board of General Mining and Finance Corporation and Messrs. R. B. Hagart and A. C. Wilson have been appointed directors of the Corporation in their stead.

Mr. F. G. Hathaway has been appointed Chief Colliery Engineer of the Westinghouse Brake and Signal Co., Ltd., London, in consequence of a reorganization of their Signal and Colliery Division.

The Adjudicating Committee, representing the Councils of the Institution of Mining and Metallurgy and of the Institute of Metal, have made the following Capper Pass Awards in respect of papers published in the Transactions of the Institution of

Mining and Metallurgy and the *Journal* of the Institute of Metals for the year 1954: Mr. Lawrie Fairs has been awarded £100 for a paper on "A Method of Predicting the Performance of Commercial Mills in the Fine Grading of Brittle Materials." Mr. F. King and Dr. A. N. Turner have been awarded £100 for a paper on "The Control of Quality in the Hot and Cold Rolling of Aluminium and Aluminium Alloys." Mr. G. L. Hopkin, Mrs. J. E. Jones, Mr. A. R. Moss and Mr. D. O. Pickman have been awarded £50 for a paper on "The Arc Melting of Metals and its Application to the Casting of Molybdenum." Professor M. Rey has been awarded £50 for a paper on "Flotation of Oxidized Ores of Lead, Copper and Zinc."

The Fifth World Power Conference, Vienna 1956, will take place from June 17 to 23. Its theme will be "World Energy Resources in the Light of Recent Technical and Economic Developments." Arrangements have been made for tours to various hydro-electric plants, thermal plants and industrial establishments. Copies of the programme are obtainable from the Secretary, British National Committee, World Power Conference, 201 Grand Buildings, Trafalgar Square, London, W.C.2.

CONTRACTS AND TENDERS

The International Co-operation Administration of the United States Government is the channel through which technical and economic assistance is given to under-developed countries. It is understood that I.C.A. has recently announced the following future authorizations for Pakistan. In each case the United Kingdom, along with other O.E.E.C. countries, has been designated as a possible source of procurement:

Commodity	Contract Period	Terminal Delivery Date	Amount (In U.S. dollars)
Pakistan			
Iron & steel mill materials, steel mill products and ferro-alloys. (PA No. 91-660-A6-6205)	13/12/55-31/3/56	30/11/56	4,299,700
Copper and copper products (PA No. 91-696-A6-6207)	13/12/55-31/5/56	31/7/56	141,700
Brass & Bronze and their products (PA No. 91-693-A6-6208)	13/12/55-30/4/56	31/7/56	95,000
Tin & Tin Base Alloys & products (PA No. 91-696-A6-6210)	13/12/55-30/4/56	31/7/56	85,000
Miscellaneous industrial non-ferrous metals & their products (PA No. 91-698-A6-6212)	13/12/55-30/4/56	31/7/56	27,500
Lead and lead-base alloys & their products (PA No. 91-694-A6-6209)	13/12/55-30/4/56	31/7/56	17,300
Cambodia			
Non-Metallic Minerals (except petroleum) and non-metallic mineral products (PA No. 42-640-99-A6-6215)	7/12/55-30/4/56	31/12/56	1,250,000

Telephone enquiries should be made to Chancery 4411, Extension 360 (Reference ESB/28667/55). Firms having agents or representatives in the countries concerned may make enquiries of the local I.C.A. Missions, who may be contacted through the U.S. Embassy or Legation in the capital.

Messrs. Bowcliffe Ltd., 31 Simmonds Street (P.O. Box 313), Johannesburg, wish to represent United Kingdom manufacturers of exhaust fans with 9, 12 and 15 in. blades and with varying rates of c.f.m. They would consider importing on their own account or on a commission basis. The company already represent a number of United Kingdom manufacturers of pumps, air conditioning and electrical equipment, and a variety of other mining and industrial requirements. They have an office in Durban.

The information is supplied by the Special Register Information Service of the Board of Trade, Lacon House, Theobalds Road, London, W.C.1. U.K. firms requiring copies of reports should apply to this address.

METALS, MINERALS AND ALLOYS

COPPER.—Copper remained firm throughout the greater part of last week in the United States but, toward the end, signs of definite softness were apparent. At the beginning of the week dealers were still getting 52 cents for first quarter copper, and even after the Chilean strike settlement 52 cents was to be had for January and February metal; the easiness showed itself in a reluctance on the part of consumers to assume commitments for positions further forward. More particularly, there was a fall in the price of scrap copper following a few days in which it had been offered more freely than for some time past. No. 2 scrap copper fell from around 41½ to 40 cents and No. 1 wire from 43 to 41½ cents per lb. There is no reason to expect a break in prices of any magnitude. Copper is going to be tight for the entire first quarter. The Chilean strike is over but, in the general thankfulness, it should not be overlooked that it cost 30,000 tons. Motor output is being cut back but no more than had been expected. In other words the position is only reverting to that of the pre-Christmas period; the immediate future is quite clear, but the outlook for the second and third quarters is beyond guessing.

Meanwhile, the danger of strikes has spread to the American fabricating industry. On January 10 work stopped at Phelps Dodge's plant at Laurel Hill, but it was described as a local dispute and was soon expected to be settled. Three plants of Revere Copper and Brass have been closed by strike for over two months, and there appears to be a chance of a strike ballot among workers of Chase Brass and Copper and of Scovill Manufacturing who are negotiating a new contract. The San Manuel Copper Corporation has produced the first copper from its mine at San Manuel, Arizona. At capacity output the mine will produce about 70,000 tons of copper a year.

The office of Defence Mobilization in the United States has ruled that only the defence programme, atomic energy and related activities will receive priorities in the allocation of copper. The order revises the present system under which certain other industries received priorities at the expense of civilian requirements.

The recent four-week shut-down at Mount Isa due to coal shortage caused a loss in production of 1,800 tons of copper. The shortage was due to the ban on overtime working among railway employees and another threat of a closure is looming up.

Japanese copper smelters are to apply a dual price system for electrolytic copper for domestic consumption. The present price will apply to about 75 per cent of the output and an increase of about 14 per cent will be applied to the remaining 25 per cent. It is not clear how tonnages under the new system will be allocated. It is said that the dual structure has been made necessary by the strength of overseas demand, though in fact a ban on exports of Japanese copper has been in force for more than six months.

LEAD.—For some days after the price of New York lead had risen to 16½ cents per lb. demand remained brisk and supplies stayed tight. More recently there has been a notable lack of vigour in the demand, though there is no indication that the new price level is in danger. The market has noted the fall in London and the growing signs of the credit squeeze there—the cutback in car production, the sharp drop on the London stock exchange. While the first rise in the price of lead had been forecast long before London supplies became tight, the second rise was in direct response to the climb in London.

If bearish sentiment in London were to spread supplies of lead might flow into America at such a rate that the price of 16½ cents would become impossible to hold. A price of 16½ cents is of course an attractive level for Mexican producers. Meanwhile a matter of some interest has arisen once again—will the General Services Administration continue to buy at 16½ cents for the stockpile? In fact the G.S.A. has bought next to nothing in recent months because the producers have had little to offer. But if the new price were to come under pressure the G.S.A. could be very helpful. G.S.A. buying could not hold a general decline but it might certainly make good a purely temporary fall in demand.

TIN.—Tin has been softer throughout the past week in New York and prices are now well below the peak of the recent rise. Spot straits metal is now down to 106.37 cents per lb. The cause of the decline has been attributed partly to the weakness in London and the East, but more especially to the lack of buying interest in the United States. It may be that the fall has not yet reached its limit, but the dominant fact in the present situation is that the American stockpile is removing more than the surplus from the market and in these circumstances it is difficult to see the price falling very much further. Strauss and Co. in their latest bulletin point out that contracts for concentrates for the Texas smelter expire for Indonesia on March 20, for the Congo on March 31 and for Bolivia on April 30. They do not see these concentrates going elsewhere for smelting till May, or becoming available as metal

before June. They do not look for any relief from the present tightness till then and think that it may get worse.

Meanwhile a strike of 500 workers is threatened at the mine of Petaling Tin and is due to begin on January 12.

World mine output of tin in concentrates in November was 14,800 tons against 15,100 in October. Malayan output dropped to 4,993 and Indonesian to 2,480 tons; Bolivian output went up to 2,700 tons and the Congo's to 1,344. Malaya exported 4,704 tons of tin metal in December against 5,993 in November, and 71,161 tons in 1955 against 66,457 in 1954.

ZINC.—Following a prolonged burst of strength on the London market the price of East St. Louis zinc was raised to 13½ cents per lb. on January 6. Since then demand has slightly fallen after holding up well in the first few days after the rise. In spite of marked weakness in London there is not yet any evidence that the new price cannot be maintained for the time being, though prolonged bearish sentiment in Europe would alter this situation. There have been some unpleasant bits of news in Europe but nothing so far to cause undue concern. The demand-supply situation could only be altered by a marked fall in industrial activity and that is not yet in sight. Meanwhile it is interesting to note that the combined American price is now at the level of 30 cents which many of the mining men are on record as saying would be satisfactory; i.e. would not call for higher tariffs. This may not be without its importance when foreign trade legislation is being discussed. American slab zinc output rose in December to 92,578 tons against 87,616 in November; stocks rose slightly from 38,058 to 40,979 tons; unfilled orders were the highest since August.

December zinc statistics showed deliveries in 1955 at 1,007,619 tons, an all-time record, and representing an increase of about 220,000 tons over the preceding year. The previous high record for the industry was 849,246 tons for the year 1950.

ALUMINIUM.—The Bureau Minier of French Guiana reports the discovery in the Kaw area of an extractable deposit of bauxite estimated to contain some 42 million tons. However, the aluminium oxide content of the ore is said to average 41.5 per cent against 50 to 60 per cent for major deposits in other countries. This is partly offset by the low silicon content of the Guiana ore. The Bureau points out that although the deposits are not far from the coast, the relatively low aluminium oxide content precludes exporting the ore for processing elsewhere and that economic exploitation could only be realised by erecting a plant on the spot. Meanwhile, it is understood that a Franco-U.S. group is studying the possibility of setting up an aluminium smelter in the neighbourhood of the capital, Cayenne. All output would be exported to the U.S.

Of particular interest in view of present power supply difficulties is a recently announced agreement whereby Reynolds will purchase from the Arkansas Louisiana Gas Co. 102,000,000 cu. ft. of gas daily for five years for use in its Arkansas Aluminium and alumina plants.

MAGNESIUM.—It is believed that when the final figures are added up, 1955 will prove to be a record peacetime year for the U.S. in the production and consumption of magnesium. Unquestionably more tonnage has gone into civilian applications than in any previous year. Requirements for consumer goods alone were expected to reach nearly 10 per cent compared with 3 per cent in 1954. The industry looks forward to an even better year in 1956, for there is no evidence of any decline in military requirements and advance orders indicate that requirements for commercial and consumer usage will rise. At a time when many metals are scarce and costly, the theme of current magnesium advertising in the U.S. is that no supply problem exists. Magnesium is also going ahead in the U.K., where adequate quantities are available at an ingot price of 2s. 4d. a lb. For the first eleven months of 1955 consumption in the U.K. amounted to approximately 11,000 tons, which compares with 7,500 tons in all 1954.

NICKEL.—No prospect of any significant easing of the worldwide nickel shortage emerges from the review of the nickel industry last year by Dr. John F. Thompson, Chairman of the Board of Directors of International Nickel. Free world production set another record with an output estimated at about 213,500 s. tons—an increase of approximately 20,000 tons over the 1954 total and 43,500 tons higher than that of 1953. The Canadian output in 1955 was expected to reach 173,500 tons, equivalent to about 81 per cent of the free world production. Of the remaining free world production, Cuba accounted for approximately 7 per cent, New Caledonia 5 per cent, Japan 3 per cent, U.S. 2 per cent, and various other countries 2 per cent. Inco's deliveries of about 142,500 tons of nickel in all forms were the highest in the company's history.

Against the higher output must be offset the higher tempo of industrial activity throughout Europe and North America, which increased the 1955 demand for nickel in every established field of interest. The U.S. received approximately two-thirds of the total free world supply, the balance being distributed to Canada, the U.K. and other free world countries. Slightly more nickel was available for civilian applications than during 1954. Nevertheless heavy defence requirements and the needs of the U.S. Government's strategic stockpile continued to place a burden on the expansion of civilian markets. Approximately 12,000 tons of scheduled stockpile purchases of nickel were diverted to industry by the U.S. Government.

INCO's commendable efforts to ensure an equitable distribution are reflected by the basic prices for Canadian nickel to industrial consumers, which remained unchanged in all world markets despite the pressure of demand.

In discussing the future outlook, Dr. Thompson said: "Free world nickel production in 1956 is expected to show an increase, with output estimated at 221,000 tons, a gain of approximately 65 per cent above pre-Korean war 1949 production. This higher output should result in more of the metal becoming available for industry in 1956 than in 1955.

On the other hand, Dr. Thompson's review of applications points to the virtual certainty that consumption will continue to be limited only by supplies, bearing in mind the growing use of chromium-nickel stainless steels and other heat- and corrosion-resistant materials of which nickel is an essential constituent.

The scarcity of nickel in the U.S. is the subject of a committee report of the National Association of Purchasing Agents. According to this report extreme pressure is said to be building up on the one hand to abandon the nickel stockpile and on the other to restore controls. The opinion is expressed that the first quarter of 1956 will see a change from current policies in an attempt to get more metal to more users. It appears to the committee, however, that even if all further deliveries to the stockpile are suspended, the additional supply of metal would not be adequate unless the current level of consumption was reduced—a solution which would scarcely be either desirable or realistic!

Mr. Arthur Flemming, director of ODM, recently announced the appointment of Mr. John R. Townsend, an industrial metal expert, to make a study of the metal for the U.S. Government and report on current and prospective supplies, Government stockpiling, and defence requirements.

TITANIUM.—After a temporary slowing down the titanium metal industry has resumed its upward surge. In the U.S. the production of sponge last year is estimated by the largest producer, Titanium Metals Corporation of America, at 8,000 tons, which compares with 5,370 tons in 1954 and 2,240 tons in 1953. A steep rise in production is expected in 1956 to meet a rapidly increasing demand. According to Mr. T. W. Lippert, Manager of Sales and Technical Service for the Corporation, current U.S. Government estimates show probable 1956 requirements for mill products ranging from 4,000 to 5,000 tons, thereby indicating that fabricators will be under extreme pressure to more than double their record activity of 1955. Mr. Lippert further stated that Britain's sole producer, Imperial Chemical Industries, had achieved virtual capacity operation of 1,500 tons annually, this output being absorbed by rapidly expanding aircraft requirements in the U.K.

URANIUM.—From Australia come reports of further discoveries of pitch-blends at Al Sharana, Northern Territory. It is also reported that negotiations have been completed for the erection of a £8,500,000 treatment plant on the Mary Kathleen uranium lease at Mount Isa, Queensland, which will be controlled by the Rio Tinto Company.

GOLD.—It is reported from New Mexico that the Onego Corporation claims to have discovered vast deposits of gold and other minerals in the San Pedro mountains, 47 miles southwest of Santa Fe. The accidental discovery of a century-old mine containing a 7 ft. wide vein of gold was said to have led to the major finds. Onego has established 20 claims, covering a 400-acre area on Oro Quay. The reports state that these contain more than 12 finds, each containing deposits of various types of minerals, from gold and silica to copper, iron and silver.

The London Metal Market

(From Our Metal Exchange Correspondent)

Following the settlement of the Chilean copper strike came news that the leaders of the trade unions which took part in the national strike (which turned out to be only partially successful) had ordered a return to work but had given warning that the unions would take strike action rotationally in protest

against the Bill to freeze prices and wages. Although some 30,000 tons of metal production has been lost by the copper strike and metal for the first-quarter is still tight, this news had a depressing effect on the market here and prices gave way sharply, although the backwardation remains around £8-£9 per ton.

Tin prices have followed the general trend and the squeeze in the cash position seems to be over at least temporarily. American consumers seem to have lost interest for the time being, and the short-time working announced in motorcar production here is not a helpful factor. On Thursday morning the Eastern price was equivalent to £819½ per ton c.i.f. Europe.

Lead and zinc have both declined from the peak prices reached last week, and, although the U.S. zinc quotation was raised ½ c., the cut in production in the motorcar industry has had a depressing effect. The fall in these metals, however, may have been, as usual, somewhat overdone, and at the time of writing signs of recovery are manifest.

Closing prices and turnovers are given in the following table:—

	January 5		January 12	
	Buyers	Sellers	Buyers	Sellers
Copper				
Cash	£39 ¼	£39 ½	£38 ½	£38 ¾
Three months	£38 ½	£38 ¾	£37 ¾	£37 ½
Settlement		£39 ½		£38 ¾
Week's turnover		7,250 tons		6,325 tons
Tin				
Cash	£83 ¾	£84 0	£81 ½	£81 7
Three months	£81 ½	£81 ¾	£80 ¾	£80 4
Settlement		£84 0		£81 7
Week's turnover		1200 tons		535 tons
Lead				
Current half month	£124 ¼	£125	£117 ½	£117 ½
Three months	£122	£122 ¼	£116	£116 ¼
Week's turnover		7,500 tons		5,125 tons
Zinc				
Current half month	£105	£105 ½	£100 ¾	£101
Three months	£102	£102 ½	£97 ¾	£98
Week's turnover		8,000 tons		8,775 tons

OTHER LONDON PRICES—JANUARY 12

METALS

Aluminium, 99.5% £179 per ton	Nickel, 99.5% (home trade) £519 per ton
Antimony—	
English (99%) delivered, 10 cwt. and over £210 per ton	Osmium, £24/27 oz. nom.
Crude (70%) £200 per ton	Osmiridium, £40 oz. nom.
Ore (60% basis) 23s. 6d./24s. 6d. nom. per unit, c.i.f.	Palladium, £8 0s./£8 10s. oz.
Bismuth	Platinum U.K. and Empire Refined £32 10s. oz. Imported £42 0s./£42 10s. oz.
(min. 1 ton lots) 16s. lb. nom.	Rhodium, ££40/£42.
Cadmium 11s. 6d. lb.	Ruthenium, £16/£18 oz.
Chromium, 6s. 11d./7s. 4d. lb.	Quicksilver, £88 10s./£89 ex-warehouse
Cobalt, 21s. lb.	Selenium, 72s. nom. per lb.
Gold, 249s. 3½d.	Silver, 78½d. f.o.z. spot and 78½d. f.d.
Iridium, £29/31 oz.	Tellurium, 15s./16s. lb.
Manganese Metal (96%-98%) £269 according to quantity	
Magnesium, 2s. 4d. lb.	

ORES, ALLOYS, ETC.

Bismuth	60% 8s. 3d. c.i.f.
	20% 3s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semi-friable) 48%	£15 2s. 6d. per ton c.i.f.
Refractory 45%	£14 2s. 6d. per ton c.i.f.
Smalls 42%	£12 2s. 6d. per ton c.i.f.
Magnesite, ground calcined	£26-£27 d/d
Magnesite, Raw	£10-£11 d/d
Molybdenite (85% basis)	105s. 3d.-108s. 1d. per unit c.i.f.
Wolfram and Scheelite (65%)	272s. 0d./276s. 0d. c.i.f.
Tungsten Metal Powder (98% Min. W.)	21s. 6d. nom. per lb. (home)
Ferro-tungsten (80%-85%)	18s. 6d. nom. per lb. (home)
Carbide, 4-cwt. lots	£39 3s. 9d. d/d per ton
Ferro-manganese, home	£54 10s. 0d. per ton
Manganese Ore Indian c.i.f. Europe (46%-48%) basis 110s. freight	90d./95d. per unit c.i.f.
Manganese Ore (43%-45%)	80d./85d. per unit c.i.f.
Manganese Ore (38%-40%)	65d./68d. per unit
Brass Wire	3s. 5½d. per lb. basis
Brass Tubes, solid drawn	2s. 10½d. per lb. basis

COMPANY NEWS AND VIEWS

U.K. Disinflation Contrasts with S.A. Record Gold Output

The recent cutback in U.K. motor production has upset confidence on the London Stock Exchange. Reflecting the uncertain outlook the *Financial Times* industrial ordinary index has lost 9.1 points since January 6 and now stands at 193.4.

The importance to the U.K. economy of a healthy automobile industry is well known and thus the danger of a chain reaction emanating from a reduction of activity should not be under-rated. It is possible that the present difficulties may prove to have been exaggerated by seasonal influences in which case the situation could improve visibly within the next month or so.

Yet the fact that falls in share quotations have not been confined to the motor industry alone but have taken place throughout the list strongly suggests that investors have viewed this latest event as a portent that the much heralded disinflationary trend has begun.

Meanwhile reports from the South African Gold Mining Industry—a traditional hedge against industrial recession—provides a striking contrast with present U.K. troubles. Total gold produced during the past year ended December 31, 1955, established a new high record at 14,602,267 oz. valued at about £178,700,000. This compares with 1954 output of 13,237,111 oz. valued at £158,600,000 and the previous record of 14,406,761 oz. attained in 1941 worth £121,000,000.

This record production figure has largely been due to expanded output from the new Orange Free State Goldfield the opening up of which has in recent months made considerable progress. In this respect the contribution of the Anglo American Corporation of South Africa has been of major significance. The picture below shows the extent of development accomplished by five mines of this group. Presidents Brand and Steyn, Welkom, Free State Geduld and Western Holdings up to September 30, 1955.

Recent reports from the group (reviewed in last week's issue of the *Mining Journal*) indicated that development in the new

field is being pushed ahead in order to raise mill throughputs to ultimate capacities—and therefore more economic levels—as soon as possible. Reflecting low tonnages treated, costs are at present running at unduly high levels. But as additional stope faces become available a great improvement should eventuate in this sphere.

Due to the largely unknown nature of O.F.S. underground conditions, it is only possible to guess at what level costs might eventually settle down. It has, however, been widely estimated that this figure might be somewhere in the region of 40s. per ton milled. This encouraging possibility, together with the fact that presently envisaged capacities of 125,000 tons per month might (although there is no official confirmation of this) eventually be increased to 150,000 tons per month, makes the shares of these companies look very attractive at their present prices. Providing as they do a hedge against industrial recession selected gold shares hold out excellent opportunities for investment and capital appreciation.

Mr. R. L. Prain "At Home" in Mason's Avenue

Mr. R. L. Prain, chairman, Rhodesian Selection Trust, was host, at an informal meeting of shareholders and the Press, at Mason's Avenue yesterday. In response to questions Mr. Prain stated that Baluba (owned as to 64.29 per cent by R.S.T.) was a marginal proposition even with copper at its present price. To operate the mine economically it was necessary to produce at the rate of 50,000 tons of copper annually. Developing along the strike between two shafts was a possible solution and this was being investigated. Similar problems confronted the Cham-bishi mine. With regard to Baluba—which recently came into production—revenue, he said, could be expected to materialize about August next.

Outlook for Rhodesia-Katanga

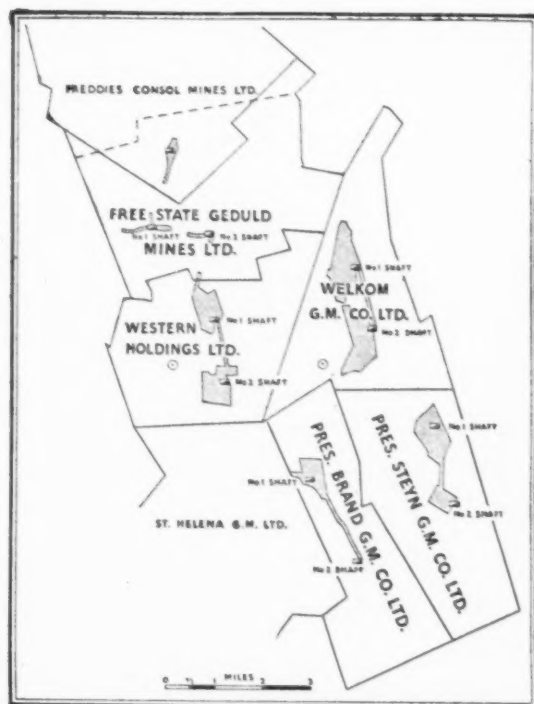
If the recent demand for Rhodesia-Katanga shares which has lifted the price to 35s. from 15s. since 1955 is any indication of the future, some interesting developments should soon be forthcoming from the Kansanshi Copper Mine in Northern Rhodesia of which it holds 35.24 per cent. It will be recalled that the Anglo American Corporation of South Africa, acting as consulting engineers to this mine are carrying out development and exploration operations. A progress report from Kansanshi covering the period ending December 31, 1955, should be published either at the end of January or in early February. Rho-Kats report and accounts will follow later round about the beginning of May.

While there have been some ultra-optimistic rumours in circulation which envisaged Kansanshi becoming another large scale operation such as Nchanga, there is, in fact, little similarity between its deposits and those of the Copperbelt. On the contrary its ore consists largely of erratically occurring veins which vary considerably in both grade and width. Copperbelt deposits are of a completely different nature being in the form of enormous mineralized blocks. Kansanshi has also a serious problem in the form of flooding below the 150 ft. level with which to grapple. It would, therefore, be ill advised to hope that the mine, at any rate at its present state of development will become an exceptionally large scale operation. But this is not to say that it will not be a successful copper producer.

Before the future potential can be realised, two major problems remain to be solved. Firstly, oxidized ore reserves at a grade of some 3.65 per cent, amounting to nearly 4,000,000 tons lie near the surface but are not yet amenable to known economic methods of treatment. Metallurgical investigations are therefore in progress with the object of finding a suitable process. Secondly, before the mine can be regarded as promising substantial reserves of sulphide ore (which is easy to treat) must be proved at depth.

In order to achieve these objectives in the most economical way, a plan has been formulated under which further exploration and development is to be partially financed by milling the small amount of 12,000 tons of 3.5 per cent ore monthly. This is expected to start some time early in 1957. Such an operation is not regarded as mining for a profit, and has been described as an extension of the exploratory programme financed by working vein ore. Sufficient quantity of this is thought to be available for the purpose.

To get an idea of Kansanshi's market capitalization it is necessary to take a line through Rhodesia-Katanga's 35 per cent



EXPLANATION

- Underground Development: Shaded areas indicate extent and direction of underground development up to September 30, 1955.
- Projected Shafts: Approximate positions of new shafts in the Welkom and Western Holdings mines.
- Proposed New Boundary between Free State Geduld Mines Ltd. and Freddie's Consolidated Mines Ltd.

holding. Ignoring Rho-Kat's other interests mainly consisting of land holdings valued at cost of some £330,000, the present price of 35s. for its 1,231,414 issued £1 shares would mean that Kansanshi's is considered to be worth about £6,000,000. To those who have Copperbelt companies in mind this seems an absurdly small sum, especially when compared with £100,000,000 for Nchanga. But in view of the great differences between the two properties it does not seem that this margin should be further narrowed until considerable additional development work has taken place. It would appear that Rho-Kat's £1 shares are, on present information, more than fully valued.

The picture would not, however, be complete without reference to the recent rumour that a deal is being negotiated between the company and Rio Tinto concerning the exploration of Rho-Kat's mineral holdings in Northern Rhodesia. This intangible factor, although possibly responsible for some of the speculative interest in Rho-Kat's shares, should not be allowed to cloud materially the issue.

1955—A Record Year for Diamonds

Sales of diamonds effected through the Central Selling Organisation on behalf of South African and other producers during the year ended December 31, 1955, constituted an all-time record. It is, perhaps, interesting to compare individual turnovers achieved by gem and industrial with those achieved during 1952, the previous record year. Although there has been a marked expansion from £45,869,857 representing gem sales during that year to £50,253,946 during 1955, industrials showed only a limited gain at £24,034,749 from £23,892,069.

Quarter 1955	Gems £	Industrials £	Totals £
December ...	11,675,034	6,512,102	18,187,136
September ...	11,138,534	5,581,583	16,720,117
June ...	12,209,324	5,004,301	17,213,625
March ...	15,231,054	6,936,763	22,167,817
Total for 1955	50,253,946	24,034,749	74,288,695
Quarter 1954	Gems £	Industrials £	Totals £
December ...	10,866,174	5,198,192	16,064,366
September ...	11,232,441	3,137,337	14,369,778
June ...	11,737,546	3,326,371	15,063,917
March ...	11,773,849	4,881,215	16,655,064
Total for 1954	45,610,010	16,543,115	62,153,125

Although past weeks have witnessed the emergence of one or two unpromising pointers to the future of the American economy, including a slight decline in automobile production, a good deal of encouragement may be drawn from the statement of Mr. Sinclair Weeks, Secretary of Commerce, made at the close of the old year. A continuing boom for United States business, he forecast, would be experienced during the first six months of 1956. As the prospects for diamond sales are inevitably largely dependent upon the level of U.S. prosperity, this outlook would appear to hold considerable promise.

Burma Corporation's Profits Up

Net profits after taxation and depreciation earned during the September quarter of 1955 by Burma Corporation (1951) rose to £143,265 from £76,838 in respect of the June quarter. Amongst the company's marketable products were 3,942 tons of lead, 348,236 oz. of silver, and 4,035 tons of zinc concentrates. Full details of the quarter's operations will be found on page 67 of this issue.

Company Shorts

Copperbelt Arranges Transport Facilities with Benguela Railway.—At the recent meeting of Tanganyika Concessions, the chairman, Sir Ulick Alexander, stated that the Benguela Railway had again been approached by Rhodesian copper companies for the transport of coal. This was likely to amount to some 70,000 tons during the next six months. The railway, he stated, was able to meet this demand. Extracts from Sir Ulick's statement to shareholders will be found on page 66 of this issue.

Westminster Bank Pays 16 per cent.—With the recommendation of a final dividend amounting to 8 per cent on its £4 "B" shares (£1 5s. paid) Westminster Bank's distribution in respect of the year ended December 31, 1955, totals 16 per cent on the £8,838,737 paid up "B" capital. This is equivalent to the 10 per cent total paid in respect of 1954 on a previous capital of

£7,070,990. Net profits earned during the past financial year rose to £1,708,316 from £1,623,197.

Temoh Produces More.—Under this heading in last week's issue it was stated that Temoh Tin Dredging's 5s. shares were quoted at around 8s. to yield nearly 15 per cent. The market quotation and the yield were correctly stated but it should be noted that Temoh Tin Dredging shares are divided into 10s. stock units and not into 5s. shares as stated.

Loloma (Fiji) Gold Mines.—Total net profits for the year ended June 30, 1955, were £A103,096 as compared with £A96,206. The balance sheet revealed current assets of £A212,706 (£A223,772) as against current liabilities of £A90,267 (£A82,672). Value of investments at cost was £A1,084,215 (£A1,031,719) while fixed assets remained unchanged at £A438,525. Mr. M. J. Cody is chairman.

RAND AND O.F.S. RETURNS FOR DECEMBER

Company	December, 1955			Year end	Current Financial Year			Last Financial Year		
	Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)	Tons (000)	Yield (oz.)	Profit (£000)
Goldfields										
Doornfontein	52	21,184	80-3 J		306	123,089	498-4	300	100,851	503-0
Libanon	96	21,302	56-0 J		583	127,093	351-3	582	122,196	309-8
Lunenburg	124	17,494	47-2 J		751	110,825	355-9	641	28,554	263-7
Rietfontein	26	5,935	19-4 D		317	71,672	246-3	329	79,486	280-1
Robinson	72	16,625	9-8 D		983	210,879	223-5	1,185	267,907	338-6
Simmer	112	19,383	14-3 D		1,423	138,842	203-2	1,496	243,008	172-7
Sub Nigel	67	20,575	70-5 J		399	126,049	476-3	398	131,219	569-7
Venterspost	115	28,106	69-7 J		731	172,099	464-7	635	156,677	377-0
Vlaakfontein	39	14,351	70-1 J		465	166,654	869-2	463	156,597	867-3
Vogels	103	26,615	154-0 J		1,235	318,301	1612-3	1,229	312,577	1423-4
West Drie	71	55,540	430-6 J		426	329,849	2605-1	319	242,147	1872-4
Anglo										
American										
Brakpan	109	18,556	16-6 D		1,281	219,170	182-3	1,321	223,186	128-5
Daggas	203	46,501	279-9 D		2,658	607,434	3702-6	2,660	615,147	3894-8
East Daggas	94	15,613	37-0 D		1,146	272,404	633-3	1,121	189,704	563-5
P. Brand	52	41,662	345-1 S		155	124,090	1027-8	116	80,290	595-0
P. Steyn	83	30,058	165-0 S		247	88,960	489-9	191	62,445	256-5
S.A. Lands	85	16,659	47-0 D		1,104	211,524	650-4	1,213	223,591	663-3
Springs	124	15,472	14-2 D		1,454	187,621	125-2	1,522	212,576	92-5
Welkom	81	17,006	17-9 S		959	193,902	141-9	864	176,242	80-8
W. Holdings	75	28,507	168-5 S		814	304,246	1652-3	592	214,809	949-4
W. Reef Ex. Central	112	22,219	51-1 D		1,401	268,388	662-4	1,395	272,451	780-5
Mining										
Blyvoor	95	54,132	367-2 J		628	356,132	2622-8	624	359,424	2766-4
City Deep	159	30,466	3-1 D		1,926	366,580	29-5	1,955	373,226	175-4
Cons. M.R.	157	23,847	12-3 J		1,034	146,755	116-6	1,060	152,162	175-8
Crown	3,592	473,188	586-7 D		6,895	899,207	1129-9	3,460	548,319	605-7
D. R. poort	173	30,567	48-1 D		2,170	367,577	603-5	2,139	354,122	568-6
E. Rand Prop	202	52,406	172-3 S		2,540	625,440	1992-8	2,475	560,469	1571-8
Harmony	71	27,699	141-0 J		623	157,117	801-9	164	59,394	169-4
Modder B.	53	5,446	0-6 D		672	67,799	12-5	677	70,711	30-8
Modder East	126	13,990	5-3 J		771	82,262	46-4	727	82,526	89-2
Rose Deep	44	7,305	3-3 D		668	104,872	60-2	839	128,079	136-7
Welgedacht	34	3,953	0-3 J		204	23,080	2-6	199	23,373	9-9
J.C.I.*										
E. Champ	18	1,149	6-3 D		337	18,037	274-1	260	24,809	72-9
Freddies C.	72	12,133	149-9 D		957	167,932	1485-8	1,112	162,282	1220-5
Govt. G.M.	226	30,558	420-0 D		3,006	380,634	284-4	3,112	406,914	396-8
Randfontein	255	25,793	100-1 D		3,118	336,681	2146-5	3,349	432,936	504-8
Union										
East Geduld	131	41,623	302-1 D		1,765	545,410	4096-4	1,653	511,388	3801-5
Geduld Prop	104	16,569	42-5 D		1,133	198,185	537-8	1,122	193,270	370-4
Grootvlei	190	41,475	237-0 D		2,322	503,448	2936-6	2,085	467,035	2620-6
Marivale	71	18,469	86-3 D		867	222,185	1068-2	800	203,895	931-7
St. Helena	98	28,183	148-3 J		1,238	32,837	1635-3	1,041	234,364	760-0
Van Dyk	80	12,905	1-9 D		962	157,656	27-2	940	161,398	20-0
General										
Ellan	31	7,875	428-5 D		369	103,946	473-6	325	101,519	532-7
S. Rood	28	6,458	22-6 J		166	37,632	134-2	165	35,796	122-2
Stilfontein	82	32,238	193-9 D		1,009	396,454	2467-4	936	351,362	2122-4
W. Rand C.	225	22,960	223-5 D		2,708	318,566	2690-3	2,750	345,425	2362-8
Anglo-Transvaal										
Hartbe's spring	53	24,512	131-8 J		298	125,519	585-9	—	—	—
N. Klerksd'p	10	1,248	96-4 D		133	6,478	19-4	133	11,477	13-2
Rand Leases	167	27,137	17-3 J		1,076	171,669	169-6	1,108	185,341	268-5
Village M.R.	34	5,004	9-0 J		206	30,350	57-2	207	31,031	61-9
Virginia	75	16,200	107-5 J		416	88,528	476-5	158	28,735	24-2
Others										
Nigel Gold	29	3,604	11-1 D		327	42,648	25-3	324	50,403	126-3
W. Nigel	19	3,990	7-4 J		110	22,871	49-5	106	23,676	58-4

* Working Profit figures include Sundry Revenue.

† Working Profit.

‡ Gold and Uranium.

a Including Bird Reef, milled 37,000 tons recovered, 1,444 oz., profit £56,000 from gold and uranium. Subject to adjustment and before provision of quarterly loan instalment of £77,100.

b Including £48,500 uranium profit—before loan and instalment repayments of £38,700.

c After crediting £45,800 estimated uranium revenue.

d After crediting £13,855 estimated revenue from pyrite.

e After crediting £375,500 estimated net revenue from uranium and acid.

f After crediting £291,000 estimated profit from uranium.

g After crediting £11,000 from uranium before deductions of £625.

h Excluding uranium profit which is declared quarterly.

i After crediting £88,557 from acid and uranium; before deducting £24,800 plant loan repayment.

ANGLO AMERICAN CORPORATION OF SOUTH AFRICA, LIMITED

(Incorporated in the Union of South Africa)

GOLD-MINING COMPANIES IN THE ORANGE FREE STATE

(All companies mentioned are incorporated in the Union of South Africa)

Extracts from the Statements by Mr. H. F. OPPENHEIMER, Chairman of the Companies.

issued with the Annual Reports (for the nine months ended September 30, 1955)

FREE STATE GEDULD MINES LIMITED

SINCE my last review of the company's affairs in April, development values have continued to be most encouraging. Frequent intersections of water-bearing strata, particularly in the No. 2 Shaft area, have, however, restricted the rate of development and have caused a slight delay in reaching production.

Earlier in the year it appeared that there was a good prospect that development on the 43, 45, 47 and 49 levels from No. 2 Shaft would soon pass out of the zone of heavy water-bearing fissures in the vicinity of the shaft, and I was able to refer to the hope of rapid establishment of stope connexions in the area. However, members will recall that a severe inrush of water occurred from the footwall on 47 level during June at a point approximately 1,500 ft. from the shaft. Despite every effort, the main pump station on the 5,100ft. level became flooded, and it was not possible to deal with the inflow by pumping. A plug was constructed in 47 level through which high pressure control pipes were led to the rising main in the shaft and the inflow was brought under control at the point above 47 level up to which the shaft had been flooded. I would like to pay tribute to the ingenuity and determination with which the consulting engineer, his staff, and the staff at the mine dealt with a most difficult and dangerous situation. Throughout the period during which the main pump station was out of commission work on the upper levels of the shaft was discontinued in view of the risk of further water intersections, and it was not until July that development could be resumed. Since then fair progress has been maintained on all levels. In the meantime, water continues to be bled from the fissure through the control pipes and led into the main pumping system and there is some evidence that this bleeding may be relieving the general pressure of water in the area.

At present, mining policy is governed in the main by two major objectives; that of reaching production at as early a date as possible, and that of creating stopes in the richer areas so that tonnages can be increased and the yield per ton milled brought to a figure representative of the mine.

First Production in January

I have not the slightest doubt that the right decision is to start production immediately we are in a position to do so even though during the first few months of production tonnages will be low and the grade in no way representative of what can be expected at a later date. Until last June there was every likelihood that we would reach production before the end of 1955, drawing ore from stopes established in both No. 1 and No. 2 Shaft areas. The inrush of water had the effect, not only of making it impossible to start production this year, but of postponing considerably the date by which significant tonnages could be drawn from stopes in the No. 2 Shaft area. On the other hand, the curtailing of operations at No. 2 Shaft released a considerable body of labour which was transferred to No. 1 Shaft, and as a result development to the north-east of that shaft has advanced more rapidly than could have been expected earlier in the year. We are now satisfied that there will be sufficient stope face available at No. 1 Shaft by the end of December to allow production to start and the first declaration will therefore be made at the end of January, during which month approximately 30,000 tons are expected to be milled.

As I have said, almost all the stopes that will contribute tonnage to the mill during the first months of production lie to the north-east of No. 1 Shaft. In that area up to the end of November 102,109 feet had been driven, of which 9,480 feet were sampled, averaging 92.57 dwts. per ton over 5.79 inches, equivalent to 536 inch-dwts. It will be apparent from these figures that a high yield cannot be expected from the mine until substantial tonnages are drawn from richer areas. Furthermore, until stoping takes place over a much wider area and, in particular, until ore is drawn in appreciable quantities from No. 2 Shaft, tonnages are bound to remain low.

I do not wish to exaggerate the difficulties during the first few months of production, but members should realize that during these months results from the mine will not approach those which can be expected later.

Development which will allow these results to be steadily and usefully improved upon is being undertaken with all speed. The 43 level haulage from No. 2 Shaft towards the Western Holdings boundary is being pressed forward vigorously on a treble shift basis. This haulage is being driven in the footwall to the Basal Reef and cross-cuts will be made to the reef at intervals to enable raises to be made to the 41 level as rapidly as possible. At the same time, in view of the extremely difficult ventilation conditions in the 41 haulage from Western Holdings, the Western Holdings company has been asked to concentrate its energies on forcing the haulage ahead with the object of holing with 43 haulage from Free State Geduld No. 2 Shaft as soon as possible. Further reef development in the area will, therefore, be limited for the time being. At the end of November, the distance between the two ends was approximately 3,200 feet and it is expected that the holing will take place in the second quarter of 1956. Raises can then be established quickly in the rich area adjacent to the Western Holdings boundary. If, as it is hoped, it proves possible to adhere to this programme, ore from stopes near the Western Holdings boundary can be expected to reach the mill towards the end of the current financial year. In the meantime, stopes will have been established nearer No. 2 Shaft and these should contribute tonnages of ore on a small scale in May, 1956.

It will be apparent, therefore, that from the point of view of the medium term outlook of the mine, the development results obtained during the next year on levels advancing southwards from No. 2 Shaft and northwards from the Western Holdings boundary will be of great significance. Apart from the two famous boreholes, development into your property from Western Holdings has given the following results up to November 30:—

Footage sampled	Percentage payable	Value (inch-dwts.)
1,075	100	1,837

In addition, to the south of No. 2 Shaft, 43 and 45 levels have intersected reef giving the following values:—

	Footage Sampled	Percentage payable	Value (inch-dwts.)
43 Level	55	100	1,617
45 Level	10	100	1,672

These values provide limited, but most encouraging, evidence that the area between No. 2 Shaft and the southern boundary will prove to be extremely rich.

At No. 1 Shaft most of the reef development done so far has been in the area to the north-east of the shaft. It will be recalled that early in 1955 an underground borehole from 47 Level, at a point 2,000 feet south of the shaft, gave a value of 6,461 inch-dwts.; and that surface borehole Mijannie No. 1, situated some 2,000 feet south-west of the shaft, gave a value of 1,747 inch-dwts. We intend to start opening up this area more rapidly during 1956 and with this end in view a haulage on 49 Level is being driven to intersect the reef in the vicinity of the underground borehole referred to above.

Progress on the interconnecting haulage between No. 1 and No. 2 Shafts will also have an important bearing on production. The connexion will be effected by means of an incline between haulages driven on 53 Level from No. 1 Shaft and on 51 Level from No. 2 Shaft. By the end of November, considerable progress had been made and the ends were 1,400 feet apart, and it is expected that the holing will be made in April, 1956. Apart from relieving the mine from the restrictions imposed by single outlet conditions, completion of the interconnecting haulage will enable the two shaft pumping systems to be linked and thus provide a much greater insurance against inflows of water than exists at the moment.

Satisfactory progress is being made on the 53 haulage north from No. 1 Shaft, which is being driven to connect up with a haulage being advanced from the Freddie's Consolidated property. At the end of November the ends of these haulages were approximately 2,000 feet apart and on the basis of the present rate of advance the holing should be effected during April. This will provide a valuable new source of ventilation for the No. 1 Shaft area.

WELKOM GOLD MINING COMPANY LIMITED

DURING this nine-month period there was a steady, if slow, improvement in monthly operating results. The more encouraging trend of development values and payability which became evident in 1954 was maintained, and the technical position at the mine as a whole improved materially.

The average milling rate of almost 80,000 tons per month achieved this year is an improvement on the 1954 figures, but is still not adequate to enable satisfactory profits to be earned. Had the native labour situation been better, higher tonnages would undoubtedly have been achieved. However, during 1955 the mine will be entitled to an increased native labour complement, which will improve matters. I should mention that quite apart from shortages of native labour, a serious and chronic shortage of European labour exists throughout the industry. Whilst this has to some extent been alleviated in the Orange Free State by means of advertising campaigns, the shortage is a national one which may well prove to be one of the chief limiting factors in the general economic expansion of the country. It is hoped, however, that, provided the supply of labour does not deteriorate further, your mine will be able to increase its tonnage milled to 100,000 tons per month during the fourth quarter of 1956.

The small margin which exists at the present time between revenue and costs, emphasises the importance of encouraging every efficiency which will lead to lower costs. Unremitting attention has been devoted by the management of the mine to this problem and considerable success has already been achieved. It is hoped that further reductions in costs will be possible during next year.

Development Progress

Development has, in general, followed the lines forecast in my statement made in April, 1955. Although values have not been quite so high as in 1954, they have continued to be a good deal better than those encountered in earlier years. In particular, work down dip to the south-east of No. 2 Shaft has continued to show up good values, as has development to the south of the shaft. The deepening of No. 1 Shaft has progressed satisfactorily and by November 30 a depth of 3,629 feet had been reached. Good progress is being made in the establishment of the 30, 32 and 35 levels and in the cutting of the 36 level temporary belt station. The additional development levels made available by this work will assist materially in strengthening the position at the mine.

As a result of the development done during the nine months, the ore reserves have increased by 460,000 tons to 2,355,000 tons and their grade has improved slightly. The yield per ton milled this year fell by 0.12 of a dwt. to a figure of 3.96 dwts, which was less than was to be expected bearing in mind the value of the ore reserves. This was due primarily to the fact that it has not yet been possible to take full advantage of the improved values obtained in development in 1954 and 1955.

Members will, I think, appreciate that stoping in a particular area usually takes place only 18 months to two years after initial development. The better values disclosed in more recent development are beginning to contribute now towards raising the average grade of ore mined and operating results should show a progressive improvement on this account during 1956.

I mentioned in my last review that President Steyn Gold Mining Company, Limited, had agreed to advance a drive on the 42 level into the south-eastern section of your property and at November 30 this drive had reached a point approximately 1,200 feet from the common boundary. The drive should cross the boundary in April and it will be possible then to obtain useful information in regard to this area of the Welkom property which will be helpful in planning future development.

Last April I explained the shaft sinking programme planned to open up the western and south-western portion of the property which is isolated from the existing workings by the Arrarat fault system. The new No. 3 Shaft comprises twin circular shafts situated 150 feet apart to provide, in the 24ft. diameter shaft, haulage and downcast ventilation capacity and, in the smaller 18ft. diameter shaft, upcast ventilation. Sinking in the latter shaft commenced in October and by November 30, 568 feet had been sunk in the Karroo shales. Sinking in the larger shaft is expected to start in the second quarter of 1956 when the necessary equipment will be available.

It is hoped that by the beginning of 1959 these shafts will be completed and that sufficient development will have been accomplished in the area to allow tonnages of anticipated higher grade ore to be mined to supplement ore from the existing shaft systems. Until this is possible the mine will not be able to mill at a rate substantially in excess of 100,000 tons per month.

The uranium extraction plant situated on the company's property has operated satisfactorily, treating slimes from Freddie's Consolidated Mines, Limited. During 1956, surplus slimes from the President Steyn Gold Mining Company, Limited, uranium plant, which treats slimes from that mine and President Brand Gold Mining Company, Limited, will be pumped to the plant on your company's property for the extraction of uranium. Uranium values disclosed in current development continue to encourage the hope that your company will be able to derive some profit from this source during the currency of the ten-year uranium production agreement, which will run from January 1, 1956. I should add that from this date onwards the company will be obliged to meet loan repayments on the capital cost of the uranium plant. The quarterly instalments, which will amount to approximately £113,000, will, however, be borne by those companies contributing slimes to the plant and unless your company actually produces uranium it will not have to meet any part of these payments from its own resources.

WESTERN HOLDINGS LIMITED

IT is particularly pleasing that your company should have been among the first three gold mining companies to make a dividend declaration in the Free State goldfield. Some 20 years have elapsed since the formation of Western Holdings Limited. But for the war the dividend-paying stage would have been reached at a much earlier date and undoubtedly at a much lower capital cost; yet now that the mine has reached this important milestone in its life and it is possible to review developments in their proper perspective, I consider the progress made to have been generally satisfactory and that the profitability of the mine will justify both the long waiting period and the capital expenditure incurred.

You will see from the balance-sheet that at September 30 the company's loan indebtedness amounted to £562,734. This sum represents borrowings on the £2,500,000 loan facilities which were granted by Anglo American Corporation of South Africa, Limited. Owing to the rate of capital expenditure having been slower than was estimated, the full amount of £2,500,000 is not likely to be required and, as the company is obliged to pay one per cent. on undrawn balances, Anglo American Corporation of South Africa, Limited was notified that the company wished to reduce the total facilities to £2,000,000.

Operating results during 1955 have shown an overall improvement. Monthly profits rose from £125,000 in January to £169,000 in November. This increase was achieved partly by increases in tonnages and partly by a useful reduction in costs. The cost per ton milled of 49s. 5d. in

November, 1955, compares with an average cost per ton of 59s. 10d. during 1954. There is room, however, for an increase in the grade milled and we must look for an improvement in this direction during the coming year.

Development has continued satisfactorily since my last review and the ore reserve figures at September 30, 1955, reflect a healthy position. Although a slight reduction is shown in the value of the ore reserve from 11.49 dwts. to 10.81 dwts., occasioned by the lower values disclosed in development during 1955, and by a slight increase in the stoping width, there is a substantial increase in tonnage, which is most important from the viewpoint of current and future stoping operations. During the nine months 716,000 tons were added to the ore reserve to make a total of 2,273,000 tons.

Work at No. 1 Shaft has been chiefly concentrated to the south of the shaft and in the area to the west and north-west, where less difficult conditions as regards water and faulting have allowed the rapid establishment of stope connections. These latter operations have had an important bearing on enabling the mine to increase its milling rate, and have brought about an increasing degree of flexibility, the lack of which in the early stages of the mine's life made it almost impossible to maintain a steady improvement in results from month to month.

41 Haulage North

The drive on the 41 Haulage due north from the shaft towards the Free State Geduld boundary continued to advance in the latter company's property. Owing to the considerable

distance from the shaft at which this work is now taking place, ventilation conditions are difficult and only slow progress can be made. In all, 1,075 feet were driven on reef within the Free State Geduld lease area up to November 30, 1955, of which 100 per cent. proved payable, averaging 1,837 inch-dwts. These are most satisfactory values and confirm the existence of the very rich area which was indicated in your property by development from the 41 level haulage some time ago. Work will continue in the Free State Geduld property as rapidly as ventilation conditions will allow. The Free State Geduld Company has requested that all work should be concentrated on advancing the haulage in order to effect a connection with development south from the company's No. 2 Shaft and further reef development in that area is likely to be limited until the second quarter of 1956.

At No. 2 Shaft development has taken place up dip to the west, to the south and to the north, and highly satisfactory progress has been made in clarifying the fault system in the area, particularly to the west and north. The demarcation of the faults has assisted materially in planning future development in the area.

No work has been undertaken recently in the centre section of the mine where, you will recall, faulting caused early disappointment. Evidence from development at both shafts towards the centre of the property however, indicates that here the position will be found to be less serious than feared and that compensating faults will allow at least the higher levels from each shaft to be joined up virtually as planned.

During 1956 work will start from No. 2 Shaft on a long cross cut on 43 Level to explore the eastern section of the mine, where you will recall, borehole D.1 indicated that the reef in the vicinity of the Welkom boundary was thrown up to an elevation of approximately 3,600 feet. At present it is not known, however, whether the area to the east of the shafts up to this fault is intersected by a series of compensating faults of a relatively minor nature or by a single substantial fault. The consulting engineers have therefore recommended that a cross-cut be driven due east and that the area be prospected by underground drilling. If minor compensating faulting is disclosed it may be possible to mine the area below 43 Level by means of incline shafts from the 43 Level. A sub-vertical shaft, will, however, prove necessary should the drilling show the presence of a major fault. This work will naturally not affect stopping operations for some time to come but it is essential that steps be taken now to gain information for the purpose of determining the policy to be followed in mining this eastern area.

Plans to Increase Tonnage

A considerable amount of preliminary work has been accomplished on the site of the No. 3 Shaft and it will be possible to start sinking both sections of the shaft system in

1956. In the meantime work will continue to advance in a westerly direction from the existing shafts in order to allow the three shafts to be connected underground with the least possible delay. As stated in my last review the tonnages of ore hauled from the new shaft will enable the mine to build up its milling rate substantially beyond 100,000 tons per month. The plant has already been extended to 125,000 tons per month capacity and the final extension to 150,000 tons per month will be undertaken in good time.

The general improvement at the mine, particularly in regard to stope face and the substantial ore reserve now in hand, will largely ensure that the mine does not suffer the setbacks experienced earlier on and we can look forward to milling at a rate approaching 100,000 tons per month by the end of 1956 and, as I suggested earlier in this review, to an increase in the grade during the year.

I should mention, however, that the mine's progress will depend to some degree on adequate labour supplies. The industry as a whole is suffering from a chronic shortage of European labour and successive recruiting campaigns are showing diminishing returns. This is a matter of national importance and I am glad to say that the Government is devoting some attention to it.

Very considerable quantities of water in aggregate are being pumped daily from the five Anglo American Corporation Group mines in the Welkom area, and disposal of this water has become something of a problem owing to its high salinity, which renders it unsuitable for agricultural purposes. Encouraging experiments are being conducted on a pilot desalting plant by the Council for Scientific and Industrial Research, but, even if these experiments prove the process to be economic, it will be some years before the necessary plant can be installed, and even then there will be a need for considerable disposal areas. Arrangements have consequently been made by the five mines to acquire rights over certain neighbouring pans which, together with existing pans and artificial dams, will ensure that adequate evaporation capacity is available to meet the possible requirements of the mines over at least the next two years. The position will be carefully reassessed from time to time to maintain as far as is possible an adequate surplus evaporation capacity.

The consulting engineers' report gives details of drilling in the area south of the Vaal River over which your company owns the mineral rights. The values obtained in boreholes P.K.5 and P.K.6 on the farm Pretoriuskraal were respectively 85 inch-dwts. (and 48 inch-dwts. in a deflection) and 33 inch-dwts. (366 inch-dwts. in a deflection). These values, read in conjunction with those obtained in other boreholes in the area, whilst indicating the presence of some payable reef, do not encourage the hope that any immediate exploitation of the area would be justified. It is not intended to carry out any further drilling at present.

PRESIDENT BRAND GOLD MINING COMPANY LIMITED

OPERATIONS have continued very satisfactorily since my last statement to members in April of this year. The exceptional rate at which profits have been increasing, coupled with the sound financial position of the company, enabled a maiden dividend of 1s. per unit of stock to be declared in September, a considerable achievement, bearing in mind that at that date the company had been in production for only 14 months.

I would like to draw your attention here to the remarkable progress that has been achieved in the short period during which the mine has been in production. The following figures illustrate the improvement which has taken place over only 16 months of operations:—

	Tons milled	Grade	Revenue per ton	Cost per ton	Working profit
			s. d.	s. d.	£
August, 1954	30,000	8.19	102 0.12	66 0.15	53,997
November, 1955	52,000	16.00	200 0.7	67 4.30	345,023

The surplus for the nine months shown in the income and expenditure account totalled £2,385,370. Of this, £650,000 was used in payment of the dividend referred to above. At the same time, the company, in terms of its undertaking to Welkom Gold Mining Company, Limited, appropriated £650,000 for the purpose of repaying portion of the £1,250,000 loan from that company. In addition, in September, 1955, the company advanced, free of interest, to Inter-Mine Services O.F.S. (Pty.) Limited an amount of £454,321, which is the company's portion of the funds required by Inter-Mine Services to finance its operations. After a careful review of the future financial requirements of your company, Anglo American Corporation

was advised that your company no longer required in full the loan facilities of £2,000,000 granted to it by the corporation earlier in the year, and that these facilities could be reduced to £1,250,000, which it was felt would be adequate for your company's requirements. Your company's total loan indebtedness, therefore, now consists of £600,000 owed to Welkom Gold Mining Company, Limited, £500,000 owed to the National Finance Corporation, and fluctuating amounts drawn against the loan facilities provided by Anglo American Corporation of South Africa, Limited. At the end of September, 1955, these facilities had been exercised to the extent of £109,407. It is apparent that the company's profit earning capacity is such as to allow it to pay steadily increasing dividends whilst at the same time repaying its loan indebtedness and meeting projected capital expenditure.

The results of development during the nine months were not as outstanding as they were in the preceding 12 months, the percentage payable falling from 94.5 per cent. to 89.2 per cent. and values from 1,420 inch-dwts. to 1,096 inch-dwts. This reduction is due partly to the fact that comparatively little development was done during the period under review in those northern sections of the property where development and surface drilling have indicated particularly rich ore, and partly to the fact that development is now taking place in the No. 2 Shaft area, where values, though very satisfactory, are considerably lower than in the vicinity of No. 1 Shaft. You will recollect that the 46 level connecting haulage between the two shafts intersected the Basal reef some 5,500 feet south of No. 1 Shaft and 4,500 feet north of No. 2 Shaft. By November 30, 1955, 1,295 feet had been sampled in this area, of which 83.0

per cent. proved payable, averaging 561 inch-dwts. These values may be compared with those obtained in the No. 1 Shaft area up to the same date, where 25,310 feet or 93.4 per cent. of the footage sampled proved payable averaging 1,319 inch-dwts.

As a result of the lower development values obtained during the year, the value of ore reserves fell from 1,011 inch-dwts. to 906 inch-dwts., the stoping width increasing from 47.42 inches to 49.92 inches. On the other hand, the tonnage increased very satisfactorily by 667,900 tons from 905,100 tons in December, 1954, to 1,573,000 tons in September, 1955.

It will have been appreciated that hitherto all stoping ore has been drawn from the vicinity of No. 1 Shaft and that the stopes prepared initially for mining were of necessity those closest to the shaft, and incidentally in a very rich area. This has created problems in two directions: the first in mining to the average grade of ore reserves, and the second in increasing the tonnage milled.

Problems of Grade

During the nine months the very high grade of the ore initially available for stoping caused a degree of overmining to take place. The actual average grade of ore milled was, of course, considerably reduced by large tonnages of lower grade development rock which were sent to the reduction plant. Nevertheless the management had to contend with a very considerable problem in preventing violent fluctuations in the grade and it was decided to allow the retention of gold in the plant to rise to a larger figure than is normal.

Now that the opening up of stopes has proceeded further and a more balanced mining policy can be followed, the company will be able to mine to its ore reserves and the problem of overmining will be remedied. I should point out, however, that a slight fall in the grade is likely as it becomes possible to mine in the lower grade areas. The fall will be gradual and is not expected to prevent monthly profits from rising, since it should be more than compensated by increases in tons milled and improved efficiencies.

In order to achieve substantially increased tonnages milled, it is essential that work on opening up stopes in the No. 2 Shaft area be pressed on with the greatest possible vigour since monthly tonnages much in excess of 50,000 cannot be achieved from No. 1 Shaft alone. The opening up of the No. 2 Shaft area is being prosecuted in three main directions. The development likely to achieve the quickest results is that being undertaken in the area to which I have referred where the 46 level connecting haulage intersected the Basal Reef some 5,500 feet south of the No. 1 Shaft. It is hoped that ore from this source will start reaching the mill during the second quarter of 1956. A cross-cut being driven north from No. 2 Shaft to intersect the reef on the 44 level in the same general area will give further scope for reef development. Unfortunately, progress on this cross-cut has been delayed by water. Secondly, preparations are in hand to sink an incline winze adjacent to

the sub-vertical shaft with the object of starting reef development down to the 50 level horizon. Thirdly, there is the sub-vertical shaft system to which I referred in my review in April of this year. Considerable progress has been made with the difficult and intricate work of establishing the necessary airways, haulages, hoist chambers and shaft collars preparatory to sinking. It is expected that this preliminary work should be completed in time for shaft sinking to start during the second quarter of 1956.

With the diverse factors involved, it is difficult to forecast the rate at which tonnages milled will increase, but our general expectation is that monthly tonnages will remain relatively static for the next four or five months, after which it is hoped they should increase sufficiently to achieve a tonnage of 70,000 tons per month at the end of 1956. At present, the capacity of the reduction plant is 75,000 tons per month and steps are being taken to increase its capacity to 125,000 tons per month.

Sinking of the 18ft. diameter ventilation section of the Welkom No. 3 twin shaft system, in which your company is interested jointly with the Welkom and President Steyn mines, was started in October. At the end of November 568 feet had been sunk. As members are aware, your company will draw a certain amount of ventilation from this shaft for the northern sections of the property, and it is intended that the 46 level drive north from No. 1 Shaft will provide the connexion with Welkom No. 3 Shaft in due course. Work on this drive has been advanced to a point some 4,000 feet north of No. 1 Shaft and it is intended to cross cut to the reef at 1,000-foot intervals in order to obtain further information in regard to the northern section of the property in the normal course of effecting the connexion with Welkom No. 3 Shaft.

Uranium Production

The extraction of uranium from slimes pumped by your Company to the President Steyn uranium extraction plant started in January, 1955, and has continued very satisfactorily. The volume of slimes available from your mine and from the President Steyn mine will shortly be in excess of the capacity of the President Steyn uranium plant, and arrangements have therefore been made for the surplus slimes to be pumped to the Welkom plant for treatment there. It is thus expected that the full output of slimes from your mine will be treated for uranium during 1956. The director's report refers fully to the production of uranium, but I think I should mention here that the first quarterly instalments in repayment of loans used to finance the construction of the President Steyn and Welkom plants will become due at the end of March, 1956. These instalments, which will amount to approximately £116,000 per quarter in the case of the President Steyn plant and £113,000 per quarter in the case of the Welkom plant, will be borne by the companies contributing slimes to the plants concerned *pro rata* to tonnages treated. This will, naturally, have the effect of reducing the net revenue derived by your Company from uranium production.

PRESIDENT STEYN GOLD MINING COMPANY LIMITED

I AM pleased to be able to refer for the first time to the payment of a dividend by the company, and I am sure members will agree that a maiden dividend of 6d. per share after only 18 months' production is very satisfactory. The dividend paid amounted to £325,000, and a similar amount was appropriated towards the repayment of the £1,250,000 loan made to the company by Welkom Gold Mining Company Limited. Appropriations equal to amounts paid out in dividends will continue to be made until the loan is paid off.

It has been possible to make major improvements to the capital structure of the company during this year. In August, 1,223,301 shares were issued, raising £2,084,553 after the payment of underwriting commission and share issue expenses. In June, Anglo American Corporation exercised the balance of its right to subscribe for shares at 20s. per share, and, as a result, the company received £1,840,000. These receipts, together with the substantial profits earned by the company, enabled it, during the nine months ended September 30, 1955, to reduce its loan indebtedness by £3,843,000 including the £325,000 which, as I have already mentioned, was appropriated towards the repayment of the Welkom loan, and, in addition, to finance its own contributions to Inter-Mine Services which had hitherto been borne by Anglo American Corporation. These contributions at September 30, 1955, amounted to £545,227, including the finance required for uranium stores.

There is one further financial matter to which I should refer. At September 30, 1955, an amount of £728,810 was being provided from the company's resources to finance a portion of the capital cost of the uranium plant. Application has been made

to the lending authorities for additional loan facilities to cover this sum; but in the intervening period and in order to allow the company to operate on a satisfactory cash basis it was arranged that Anglo American Corporation of South Africa Limited, would provide loan facilities of £500,000 until December 31, 1955. These facilities bear interest at six per cent. per annum on amounts drawn and one per cent. on amounts undrawn.

Favourable Underground Conditions

Milling operations have maintained a highly satisfactory trend in 1955 and, as a result of increased tonnages and grade, monthly profit figures have increased at an excellent rate. The satisfactory progress which the mine has made is to a great extent a reflection of the favourable conditions encountered so far underground. As you are aware, water problems have not assumed serious proportions and faulting has been limited and well demarcated.

Turning to development operations I would like to comment in particular on the significance of results obtained during the last six months. Values published in respect of the September quarter were lower than the average to that date and this information appeared to cause unnecessary concern. Members are aware that the trend of development values as disclosed by sampling over the last few years has shown that the area opened up from No. 1 Shaft is of a generally poorer grade than the area lying to the south and west of No. 2 Shaft. Work during the latter part of the year, particularly from No. 2 Shaft, has been concentrated on the rapid development of levels

in the centre portion of the mine, between the two shafts where the values tend towards the general average disclosed in No. 1 Shaft area. In order to allow this work to go forward at full speed, it has been necessary to restrict development in the richer area to the south-west of No. 2 Shaft, with the consequence that the average grade of ore sampled has fallen. During 1956, when the levels to the north of No. 2 Shaft have been sufficiently far advanced, lateral development will again be resumed in the southern area, where quarterly results can be expected to improve. I must emphasize that the results of any particular quarter's development are not necessarily representative of an overall trend and that, at this early stage in the mine's life particularly, fluctuations are to be expected.

Recently, rather more attention has been given to the leader reef, which lies some 60 feet above the basal reef, and useful results are being obtained. The normal method of development in the mine is by means of twin haulages and in certain areas it has been found possible to carry the return airway section of the twin haulage on the leader reef, thus enabling substantial footages to be prospected during the normal course of basal reef development. Apart from the gold values disclosed, the leader reef has a promising uranium content, and it is hoped that useful tonnages will become available for mining from this source in due course. I must add, however, that considerably greater footages will have to be accomplished on the leader reef before any long term assessment of its value can be made.

Development is being carried out on the 42 level north from No. 1 Shaft towards the Welkom Gold Mining Company boundary and at the end of November this haulage had reached a point 1,200 feet from the common boundary. The haulage will be continued on into the Welkom property where prospecting will be carried out on behalf of the Welkom Company.

I explained last April that the company had agreed to participate with President Brand and Welkom in sinking a shaft on the latter company's property, and it is intended that the north-western portions of your property will draw ventilation from the shaft in due course. To the end of November a total of 568 feet had been sunk in the 18ft. diameter ventilation

section of this twin shaft, and sinking operations on the 24ft. diameter hoisting section will be started next year. In the meantime a start has been made on the connecting haulage which will be driven to the Welkom shaft from the upper workings of your mine to the north-west of No. 1 Shaft.

As a result of the excellent progress maintained in development during the year the ore reserve position at the mine has shown a most satisfactory improvement. At September 30, 1955, the estimated payable reserve was 2,524,500 tons at an average assay value of 8.49 dwts. over a stoping width of 48.12 inches. Compared with the ore reserve at the end of 1954 these figures show an increase of 743,500 tons, and an increase in value of 0.18 dwt., while the stoping width is 0.10 inch narrower. The substantial tonnage increase now places the mine in a healthy position, but it is intended to continue excess development until the ore reserve reaches a figure in excess of three million tons. Thereafter, development will be conducted on a replacement basis only. The reduction of development in this manner will have the effect of assisting to reduce working costs which at present bear portion of excess development charges.

The reduction plant has a present milling capacity of 125,000 tons per month and work is in hand to increase the treatment section of the plant from 100,000 tons per month to 125,000 tons per month. This will give adequate capacity for immediate tonnage increases and, provided the supply of European and Native labour proves sufficient, it is expected that the mine will mill at the rate of 100,000 tons per month in the last quarter of 1956.

The treatment of slimes from the gold reduction plant for the extraction of uranium has continued very satisfactorily and the profit from this source amounted to £235,288 for the nine months ended September 30, 1955. The volume of slimes available from your mine and from the President Brand mine will shortly be in excess of the capacity of the uranium plant on your property and arrangements have therefore been made for the surplus slimes to be pumped to the Welkom plant for treatment there. It is thus expected that the full output of slimes from your mine will be treated for uranium during 1956.

LORAINÉ GOLD MINES LIMITED

IN June the Directors announced in the Press that an over-valuation of the reef had occurred in earlier sampling operations at the mine and I would like to take the opportunity of elaborating on the basic facts set out in the announcement. The mine was brought to production in May, 1955, and it soon became apparent that the recovery of gold from the reduction plant was less than was to be expected from the values obtained in sampling. Discrepancies of this nature, which are not uncommon during the early stages of production on new mines, are normally due to some remediable defect in the metallurgical process of recovery, to a loss of gold in actual mining operations, or to dilution of the ore underground by waste rock, and the company's consulting engineers immediately turned their attention to tracing possible faults due to one or other of these causes. Investigations showed that the recovery process was operating to full efficiency. Underground, certain modifications in mining practice were instituted to obviate possible dilution and loss of gold but these did not significantly increase the gold recovery factor.

At this point it became necessary to look further afield. The question of sampling came under review and a programme of resampling was undertaken in the stopes currently being mined. This work showed that the stope values were lower than expected and the consulting engineers recommended an immediate resampling of all Basal reef developed in the mine.

This programme of resampling established that the reason for the over-valuation of the reef in original sampling operations was the extreme hardness of a band of mineralized quartzite immediately overlying the Basal reef. This band of quartzite is not found in similar association with the Basal reef in other mines of the Anglo American Corporation Group in the Free State, and it has now been found that when sampled in conjunction with the Basal reef, it is not amenable to conventional sampling practices.

Now that the problem has been defined it is of course possible to devise means of dealing with it and the sampling practice now being used is giving accurate results.

As members have been informed, the resampling has indicated not only lower values but a lower percentage of payable footage driven on Basal reef than was originally thought to be the case. The lower percentage payability means particularly that a greater development footage has to be driven to establish any given tonnage of payable ore reserves which in turn must have its reflection in increased costs.

It is evident that the mine must seek by every means to achieve the highest possible efficiencies in mining and a low milling width. The absence of significant water-bearing fissures and faulting assists considerably in allowing development to be undertaken at a high speed. At the same time, by virtue of the semi-resue method of stoping in the mine, careful planning and supervision, and a degree of surface sorting, the management has been able to reduce the milling width below 40 inches. It is hoped that it will be possible to maintain this position in the future.

In view of the disappointing results indicated by resampling and current sampling in the area between the two shafts, it has been decided to undertake development from both shafts down dip towards the western sections of the mine. In this area, borehole Kromdraai No. 2, situated 4,200 feet to the north-west of No. 2 Shaft, gave values of 421 inch-dwts. in an intersection of the Basal reef at 5,476 feet, while borehole Tredenhams No. 1, 3,400 feet to the north-west of No. 1 shaft, gave a value of 385 inch-dwts. in an intersection of Basal reef at 5,738 feet. These boreholes indicate a probable trend of better values and every effort will be made to establish stoping connections in the area. However, the present bottom working level of both shafts is at 5,200 feet and in order to gain access to the deeper areas in the vicinity of the boreholes it has been necessary to start work on a sub-incline shaft from No. 1 shaft. This work is proceeding satisfactorily and the consulting engineers estimate that the shaft will be in operation by March, 1956. In addition, a number of winzes are being driven down from the 52 level and it is expected by this means to establish at least two further levels at 5,400 and 5,600 feet.

"B" Reef Development

In the meantime, certain exploratory work has been carried out on the "B" reef in the immediate vicinity of No. 2 Shaft. To the end of November, 1,630 feet had been sampled on this reef, of which 52.8 per cent. proved payable averaging 751 inch-dwts. Most of this development has been in the shaft pillar; but a cross-cut has been driven from the 44 level to pick up the reef outside the shaft pillar and it is hoped that it will be possible to establish the first stope connection on this reef towards the end of the first quarter of 1956. In Lorainé the "B" reef occurs at approximately 600 feet above the Basal reef, and it was intersected in both shafts and in two boreholes with the following results:—

No. 1 Shaft.—53 inch-dwts. at a depth of 4,171 feet below surface.

No. 2 Shaft.—348 inch-dwts. at a depth of 4,170 feet below surface. Borehole No. 1 on the farm Kromdraai.—190 inch-dwts. at a depth of 6,384 feet below surface.

Borehole No. 1 on the farm Uitkyk.—112 inch-dwts. at a depth of 4,777 feet below surface.

In view of the limited data provided by surface drilling, it is evident that a considerable amount of underground development will have to be undertaken before any useful assessment of the potentialities of the "B" reef in the mine will be possible.

The mine has not been in production long enough nor has sufficient development been accomplished under the circumstances to enable firm estimates to be made of what the optimum rate of production will be or of the cost structure and grade of the mine at full production. In the meantime, it is expected that by increasing tonnages and improving efficiencies the monthly working loss will be reduced gradually, but I think it should be stated frankly that if the mine is to depend on Basal reef values and payability such as those so far disclosed by underground development, it must be looked on as a marginal proposition.

However, there is a reasonable prospect that development

down dip will enable stopes of a higher grade to be established. In addition, of course, continued satisfactory development on the "B" reef will enhance the mine's long-term prospects considerably.

It is evident that the mine must concentrate its energies, on the one hand, on attempting to reach a stage of profitable production on the basis of existing ore reserves, and, on the other hand, on undertaking prospecting with all speed in promising areas. In order to allow the company to meet current expenditure and carry out the necessary prospecting work, Anglo American Corporation of South Africa Limited, has agreed to grant special additional loan facilities of £1,250,000 until December 31, 1956, when the position will be reviewed. The total facilities available to the company are thus £4,000,000.

The Corporation has agreed, in addition, to treat all drawings on the total facilities of £4,000,000 as interest free for the period December 1, 1955, to December 31, 1956, when the matter will be reconsidered. This concession will very materially assist the company's finances.

I regret that I am unable to announce definitely that the mine has been admitted as a uranium producer. At the time of going to press it appeared very likely that the authorities concerned would accept the company as a producer and, should this prove to be the case, we should be able to earn profits from the extraction of uranium from residue slimes.

Copies of the Reports and Accounts of all the afore-mentioned Gold Mining Companies may be obtained from the London Secretaries of the Companies: Anglo American Corporation of South Africa Ltd., 11 Old Jewry, E.C.2.

TANGANYIKA CONCESSIONS LIMITED

A CENTRAL AFRICAN TRANSPORT PROBLEM

SIR ULICK ALEXANDER'S REVIEW

The Annual General Meeting of Tanganyika Concessions Limited was held on January 5, 1956, at the Head Office of the Company, Tanganyika House, Salisbury, Southern Rhodesia, the **Right Honourable Sir Ulick Alexander, G.C.B., G.C.V.O., C.M.G., O.B.E.**, the Chairman, presiding.

The following is an extract from his circulated Review:—

"From the Accounts you will notice a profit after taxation amounting to £3,000,830 and your Directors have been pleased to propose the payment of a Final Dividend of 55 per cent. on the Ordinary Stock, which, if approved, will make a total dividend of 70 per cent. for the year.

"The increase in profit is this year not entirely due to the prosperity of the Union Minière du Haut-Katanga, although this Company increased its net dividend from Belgian Francs 1,450 for the year 1953, to Belgian Francs 1,600 for the year 1954. This year besides having received a full year's debenture interest from the Benguela Railway Company amounting to £308,601 we have also received a maiden dividend of £368,944, while arrears of debenture interest totalling £579,302 have been credited to the Appropriation Account. I am sure that Stockholders will join with me in congratulating Dr. Alexandre Pinto Basto and the Board of the Benguela Railway Company on this satisfactory state of affairs."

CHAIRMAN'S ADDRESS

The Chairman addressed the Meeting as follows:—

"I am glad to be able to present to stockholders a report and accounts showing once again a record profit.

"You will have seen in my review that Mr. Godfrey Hutchinson, after having been a director for 39 years, has retired from the Board. Throughout his long service he has played with success a most prominent part in the company's activities, especially in guiding it through some of its most difficult periods. I trust therefore in expressing the regrets of his colleagues and extending to him our gratitude and thanks, I am also voicing the sentiments of the whole body of stockholders.

"We were fortunate in being able to fill the vacancy so caused, by the appointment of his son, Mr. Robert Hutchinson, whom we were very pleased to welcome to the Board.

"Since the publication of my review the Union Minière du Haut-Katanga have declared an interim dividend in respect of the year 1955 of 600 francs per share, which is the same as the interim dividend for the last three years.

THE BENGUELA RAILWAY

"I think it appropriate that I should say a few words upon the contribution which our subsidiary company, the Benguela Railway, has made towards the development of the Central African Federation, and could make in the future should it be required to do so. We, as you know, own all the debentures and

90% of the share capital of the railway. As a British Company with our Head Office in Salisbury it is our desire to assist in the further development of the Federation to the best of our ability. There are difficulties, however, and so that you may appreciate our problems I must give you a little of the history.

"The connection with the Rhodesia Railways was established by the completion of the Congo Railways in 1931, and in September of that year the Benguela Railway and the Congo Railways agreed to the introduction of through port rates from Lobito to the frontier at Sakania on goods destined for Northern Rhodesia. Traffic then began to flow in a small way and importers began to realize the advantages which the route had to offer. However, on January 1, 1933, the Rhodesia Railways introduced special reduced rates on certain classes of goods consigned from Beira to Ndola and from Beira to the Congo Border, thus enabling them to compete with the flow of traffic over the Belgian Route Nationale from Matadi and also the Benguela route from Lobito. This led to the cancellation of the Lobito through rates to the Rhodesian Border and the Benguela Railway thereupon introduced special rates over their own part of the route in order to make the total cost competitive and of interest to Rhodesian importers. From then onwards until 1937 traffic continued to move via Lobito although in very small quantity. In that year, however, as a result of further representations by Rhodesia Railways to the Congo Railways, the Benguela Railway was forced to withdraw even these special rates, and just before the war broke out in 1939 the traffic via Lobito ceased almost entirely.

INADEQUACY OF PRESENT SYSTEM

"The general picture of African transport was then very different from what it is to-day. In those days the development of Central Africa was proceeding slowly and it was natural that each Railway system sought the maximum amount of traffic to make it pay, and so adequately to serve the development of the territories through which they ran. To-day, however, the situation is completely changed and since the war there is more traffic in some areas than the railways can carry. In spite of a conference called by the Colonial Office in 1947 with a view to making greater use of the Lobito route, and the Johannesburg conference in 1951, which resulted in an agreement for the carriage of a maximum of 2,000 tons of general cargo a month to Northern Rhodesia, the difficulties still continue as this amount of capacity is quite inadequate to relieve the situation. In 1953 the output of coal from Wankie was insufficient to provide the Copperbelt with their requirements and arrangements had to be made for shipments of coal from South Africa and America via Lobito. The Benguela Railway was very happy to help by carrying this traffic which amounted to 160,000 tons during the period October, 1953, to August, 1954. This traffic was hardly remunerative but I understand the output from

Wankie can now meet any demands likely to be made and we were led to believe this expedient would not be repeated. However, I have to inform you that the Benguela Railway has again been approached by the Copper Companies for the transport of remedial coal shipments, which are likely to amount to some 70,000 tons during the next six months. It so happens the Railway is in a position of being able to meet this demand as there is at the moment spare capacity in an inwards direction of 15,000 tons and spare capacity for exports of 8,000 tons a month, due to some extent to the additional finance provided by your Company last year for capital expenditure on the Railway. I am sure you will agree with me the Benguela Railway cannot be expected, unless existing arrangements are amplified, always to have reserve capacity for this purpose, since it has to be remembered that traffic in the Congo and Angola is steadily increasing and the rapid development of those territories is likely to produce appreciably more traffic for the Lobito route in the not far distant future. The present surplus capacity must therefore be expected to diminish. It is for this reason we should welcome a clear indication from the Government of the Federation whether it is their policy, as it would certainly seem to be in the interests of their territories, to take advantage of the Lobito route. I should not like to see a situation arise in a few years' time when, through lack of foresight to enable us to make the necessary long term plans, the Lobito route might have to refuse Rhodesian traffic and so possibly impede the development of the Federation.

NEED FOR CO-OPERATION

"In my view the railway systems in Southern Africa should work in the closest and friendliest co-operation to make the utmost use of the facilities available, instead of what appears to be the present tendency to erect barriers which in the long run must retard development of the territories concerned.

"During the year your staff have carried out their work most efficiently and played their part to the full in obtaining the satisfactory results for the year. In acknowledging this on your behalf I may say that your Board has introduced a bonus scheme as some tangible expression of our appreciation and thanks."

The Report and Accounts were adopted, the payment of the final dividend was approved and the retiring directors were re-elected. The Special Resolution providing additional remuneration for the directors was also passed.

BURMA MINES LIMITED

The following summarises the Operating results of Burma Corporation (1951) Limited (Incorporated in the Union of Burma and jointly owned by Burma Mines Limited and the Union Government) for the THREE months ended September 30, 1955.

ORE EXTRACTION

29,394 tons

PRODUCTION

Concentrating Ore Milled (tons)	Oz. Silver	% Lead	% Zinc
29,151	14.87	17.79	11.88
Marketable Products were as follows:—			
Refined Lead	3,942 tons
Refined Antimonial Lead	85 tons
Refined and Dore Silver	348,236 fine ozs.
Copper Matte	66 tons
Nickel Speiss	14 tons
Zinc Concentrates (57%-58% Zn)	4,035 dry tons

ESTIMATED REVENUE AND EXPENDITURE

Estimated Gross Revenue (after adjustment of value of metal stocks)	K. 1,04,50,400	£783,780
Estimated Operating Expenditure	K. 58,74,500	£440,588
Estimated Operating Profit	K. 45,75,900	£343,192
Estimated Taxation	K. 24,92,000	£186,900
Estimated Depreciation	K. 1,73,700	£ 13,027
Capital Expenditure	K. 2,43,700	£ 18,277

After deducting the foregoing estimates for Taxation and Depreciation the estimated Net Profit for the Quarter is K.19,10,200 (£143,265) which compares with a Net Profit of K.10,24,500 (£76,838) for the previous Quarter.

The Sterling figures shown are based on a Rate of Exchange of 1s. 6d. per Kyat.
37, Dover Street, London, W.1.

MINE RETURNS

OIL OUTPUT

Company	November (in tons)	Months Since Year End	Cumulative Totals (in tons)	
			This year to date	Last year to date
Anglo Ecuadorian	26,514	8	217,974	217,453
Apex Trinidad	36,339	2	73,433	74,737
Kern Oilfields	27,036	6	156,724	158,038
Kuwait Oil	4,722,542	10	45,162,457	38,543,619
Lobitos Oil	42,474	11	482,966	455,855
Qatar Petroleum	474,187	10	4,437,806	3,850,663
Trinidad Central	7,569	11	89,063	96,591
Trinidad Leaseholds	80,994	5	392,369	401,781
Trinidad Petroleum	47,501	4	185,084	163,551
Ultramar Oil*	106,935	11	1,182,603	1,197,178

Note: 1 ton taken to equal seven barrels. *Output figures are for S.A.P. Las Mercedes in which Ultramar holds a 50 per cent interest.

COAL OUTPUT

Company	November (in tons)	Months Since Year End	Cumulative Totals (in tons)	
			This year to date	Last year to date
Amal. Coll. of S.A.	548,619	11	6,333,750	6,326,199
Apex	82,212	11	934,575	884,750
Blesbok	50,244	11	504,255	486,472
Coronation	88,129	11	975,104	954,789
New Clydesdale	84,735	5	115,210	370,139
New Largo	90,386	11	1,112,653	915,598
S.A. Coal Est.	136,066	3	688,169	677,233
Springbok	76,621	11	797,776	757,853
Transvaal & Delagoa	124,437	3	375,094	374,288
Van Dyks Drift	66,243	11	642,485	566,533
Vierfontein	111,069	11	1,219,645	888,029
Vryheid Cor.	52,355	11	532,174	462,454
Vryheid Cor.*	40,957	11	434,801	388,917
Wankie Coll.	306,192	3	902,080	818,792
Wankie Coll.*	17,849	3	54,295	47,180
Witbank	142,983	11	1,642,225	1,465,733

*Coke.

TIN OUTPUT IN TONS OF TIN CONCENTRATES

Company	Nov.	Months since year end	Financial Year to Date		Company	Nov.	Months since year end	Financial Year to Date	
			This	Last				This	Last
EASTERN									
Ampat	94	11	1265	1146	Bisichi	63	11	6784	596
Berjuntai	221	7	493	434	Ex Lands	31	11	339	269
Ipoh Tin	21	8	166	363	Gold & Base	43	11	517	523
Kamunting	166	8	1232	736	Gold & Base†	48	11	516	448
Kinta Tin	27	11	352	317	Jantar	17	11	163	136
Klang River	17	8	182	211	Jantar	000	0	000	000
Kramat Tin	29	8	260	228	Jow Tin	000	0	000	000
Kuala Kampar	139	8	1285	1746	Kaduna P.	9	4	47	54
Kuchai	62	2	151	80	Kaduna S.	3	11	60	64
Larut Tin	72	11	901	1114	London Nig.	11	11	215	308
Lower Perak	268	7	1430	1118	Keft†	19	8	156	184
Malaysiam	14	8	1052	842	Naraguta Ex.	25	8	323	288
Pahang Cons.	180	4	842	880	Naraguta S.	11	11	95	71
Rahman H.	31	5	159	179	Naraguta Tin	7	11	123	162
Rantau	627	5	264	308	Naraguta Tin†	11	11	141	179
Rawang Conc.	34	8	188	342	Ribon	11	11	68	77
Rawang Tin	94	8	864	483	Ribon†	14	8	140	74
Renong	55	5	324	502	S. Bukeru	1	8	23	8
Southern Kinta	271	8	2132	3150	S. Bukeru†	3	11	56	64
Siamese Tin	234	11	2260	1751	Tinfields of Nig.	2	11	62	2
Sungei Kinta	33	11	297	142	Tinfields of Nig.†	1	8	13	20
Taping	63	11	615	591	U. Tin	Nil	8	11	20
Tambah	21	11	150	216	U. Tin†	12	5	64	68
anyong	108	11	1016	686	MISC.	3	5	43	18
Tongkah Har.	46	5	312	218	Berali Tin	17	8	104	37
NIGERIA									
Amal. Tin	280	8	2790	2960	Berali Tin‡	158	8	1329	1361
Amal. Tin†	17	8	367	447	Greevor Tin	55	8	427	412
					S. Crofts Tin	68	11	644	532
					S. Crofts Tin‡				

*Quarterly.

†Columbite.

‡Wolfram.

a Dredge worked railings temporarily as necessitated by dredge course.

b No. 2 dredge worked through line of road deviation at flotation depth.

From magnetite to monazite—

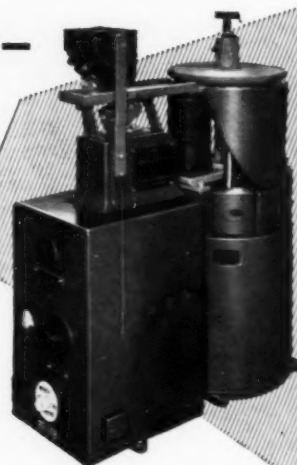
THE DAVIES '45' MAGNETIC SEPARATOR

separates them all!

No assay or mineral testing department can be complete without this Magnetic Separator—the Davies '45'. It is designed especially for laboratory and prospecting stations and will effectively separate all magnetic minerals from magnetite to monazite. A leaflet has been prepared which tells you more about it—shall we send you one?

DAVIES MAGNET WORKS LTD

LONDON ROAD • WARE • HERTS Phone: Ware 489
DM 1715/A



Some Mechanical Specifications:

Variable speed feeder. Full magnet control. Solid cast bed plate, take-off chutes and collecting bins. Wired for direct operation from A.C. Mains supply. All electric parts built-in and impregnated for continuous rating for tropical conditions. All mechanical wearing parts reduced to a minimum.
Nett weight: 196 lb. Boxed weight: 306 lb. Cubic Dimensions (boxed) 13 cu. ft. Overall Dimensions: 12" x 25" x 30".

Davies also manufacture:

High intensity non-entraining and induced roll heavy duty Magnetic Separators: Prospector and laboratory Magnetic Separators: Vibrating screens and Concentrating tables.



Illustrated brochure and price list on request to Dept. MJ.

WILKINS & DENTON LTD

51-52 WOBURN PLACE, LONDON, W.C.1.



All genuine TOTECLOR brand Footwear carries the Registered Trade Mark and "Safety First Tag".

Foot injuries account for ONE accident in SIX



SAYS MASTER TOTECLOR

Here's another casualty that could have been prevented with TOTECLORS. These famous safety boots and shoes are helping to reduce foot accidents in mines, foundries and factories everywhere. Tough, yet comfortable in wear, they are fitted with a neatly concealed steel toe-cap capable of withstanding a dead weight of 3 tons. Industrial Safety and Welfare Officers are invited to apply for full details.

TOTECLORS

—Safety boots and shoes



old refining

Our precious metal smelting and refining service is founded upon more than a century of experience and planned development. A gold refining capacity in excess of 400,000 oz weekly is supported by methods of sampling and assay that assure the speedy and critically accurate assessment of the precious metal contents of any form of gold-bearing material.

Silver and Platinum

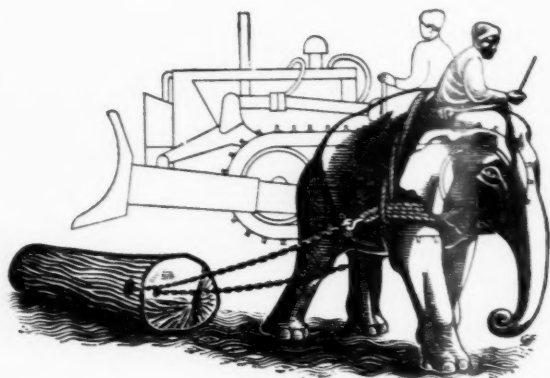
Our refineries handle also bullion, ores, concentrates and mining by-products containing silver and the platinum metals.

Johnson  **Matthey**

MELTERS AND ASSAYERS TO THE BANK OF ENGLAND

JOHNSON, MATTHEY & CO., LIMITED • HATTON GARDEN • LONDON • E.C.1

Telephone: HOLborn 6989



It is impossible to judge from statistics alone how far India's *traditional industries are being reshaped* by Western machines and methods. A first hand experience of Indian life and commerce, like that of the National Bank of India, is needed to put facts into perspective. Enquiries about trade here, or with any other country which is served by the Bank, are welcomed at the Head Office or at any branch.

NATIONAL BANK OF INDIA LTD. Head Office: 26, BISHOPSGATE, LONDON, E.C.2

West End (London) Branch: 13, ST. JAMES'S SQUARE, S.W.1

Branches in: INDIA, PAKISTAN, CEYLON, BURMA, KENYA, TANGANYIKA, ZANZIBAR, UGANDA, ADEN AND SOMALILAND PROTECTORATE

Bankers to the Government in: ADEN, KENYA COLONY, UGANDA AND ZANZIBAR



The crank shaft is the heart of the engine and the lubricating oil is its heart's blood.

Stream-Line filters enable first grade lubricating oil to be kept always perfectly clean and used over and over again, increasing running efficiency and effecting a big saving in overhauls and maintenance.

Over 50,000 users are proving the value of Stream-Line filters in the economical operation of i.c. engines.

STREAM-LINE FILTERS

Make oil lubricate longer



STREAM-LINE FILTERS LTD, INGATE PLACE, LONDON, S.W.8. TELEPHONE: MACAULAY 1011



"You wouldn't think I was a customer of the Westminster Bank, would you?"

I'm not really, I suppose.

But Dad made something called a Trust—I'm not quite sure about the details. Anyway, the Westminster Bank looks after the money and pays my school fees and arranges about my pocket money and all that sort of thing. I must say they're jolly decent about everything. I go and see the man at the Bank sometimes, in fact we're pretty friendly really.

He seems to take an interest in me, if you know what I mean—makes a fellow feel sort of comfortable . . ."

The Trustee Department's Services are fully described in a booklet called 'The Westminster Bank as Executor or Trustee' available free of charge at any branch of the Bank.

WESTMINSTER BANK LIMITED

TRUSTEE DEPARTMENT



‘NOBEL-GLASGOW’ Explosives and Accessories

There is a ‘Nobel-Glasgow’ explosive for every blasting operation.

Users are invited to apply to the Nobel Division of Imperial Chemical Industries Limited for assistance with their problems.

IMPERIAL CHEMICAL INDUSTRIES LIMITED
NOBEL DIVISION, 25 BOTHWELL STREET, GLASGOW, C.2



POSITION OPEN—ASSISTANT MANAGER

Large base metal mining company in East Africa offers excellent opportunity for Assistant Manager. Applicant must be graduate Engineer, married, under 45, with broad mining and administrative experience. Salary Open. Forward complete résumé of educational and experience records. All information will be kept confidential. Write Box 575, The Mining Journal Ltd., 15 Wilson Street, Moorgate, London, E.C.2.

MINERALOGIST required by Alluvial Mining Company in NIGERIA. Work would include primary, Columbite and Ore Dressing Research. Must hold honours degree Geology/Mineralogy. Salary from £85 per month according to experience. Free quarters, light and fuel and personal equipment. Provident Fund and non-contributory Pension Scheme. First engagement for two years followed by four months leave on full pay, subsequent tours eighteen months with three months leave. Should be under 35 years. Write giving full particulars of qualifications and experience to Box M.J. 531, c/o 191 Gresham House, E.C.2.

POSITIONS AVAILABLE

Applications are invited for the following staff positions by **URUWIRA MINERALS LIMITED**, located at Mpanda, Tanganyika, East Africa, in their concentrator treating 1,200 tons per day of Copper-Lead ores by Heavy Media and Flotation. Healthy climate, altitude 3,500 feet, on principal air line.

Positions open for: Metallurgists and Shift Bosses.

Qualifications: Graduate of University or School of Mines, experience in concentrators advantageous, but not essential.

Salary and Contract: Range—£60—£75 sterling currency per month, depending upon experience. 30-month contract, free passage to Tanganyika and return with three months full pay on leave after completion of contract. 15-day vacation with air fare paid to Nairobi or Dar es Salaam after 15 months. Free quarters. Production bonus.

Position offers excellent opportunity in expanding Company.

Applications should be forwarded by airmail to:

THE GENERAL MANAGER,
Uruwira Minerals Limited,
Mpanda, Tanganyika.

AGENCE MINIÈRE ET MARITIME S A
2, RUE VAN BREE — ANTWERP — BELGIUM

Sworn weighers, samplers of ores, metals and residues. Agents for shippers at European ports and plants.

Market surveyors and advisers assuring sales direct to consumers
Telegrams: Rentiers-Antwerp

THE WORLD'S GREATEST BOOKSHOP

FOYLES
** FOR BOOKS **

FOR ALL YOUR
Technical Books

Foyles have depts. for Gramophone Records, Stationery, Handicraft Tools and Materials, Music, Magazines, Subscriptions, Lending Library, Foreign Stamps.

119-125 CHARING CROSS RD., LONDON, W.C.2

Gerrard 5660 (20 lines) * Open 9-6 including Saturdays
Two minutes from Tottenham Court Road Station

PREMIER ACETYLENE LAMPS

*For
Mining
Purposes*



The Premier Lamp & Engineering Co. Ltd.

MOORFIELD WORKS
ARMLEY · LEEDS 12
ENGLAND

WOLVERHAMPTON DIAMOND DIE & TOOL Co. Ltd.

BOARTS
and
**INDUSTRIAL
DIAMONDS**
Exporters

**11 HATTON GARDEN,
LONDON, E.C.1.**

Telephone: HOLborn 3017 Cables: Pardimon, London

Metal and Mineral Trades

Established 1797

Members of the London Metal Exchange

DERBY & CO., LTD.

11-12 ST. SWITHIN'S LANE, E.C.4.

Telephone: MINCING LANE 5272

Specialists in

WOLFRAM, SCHEELITE, CHROME, MOLYBDENITE, TANTALITE, COLUMBITE
RUTILE, ILMENITE, BERYL, ZIRCON AND OTHER MINERALS

Smelters and Refiners of

GOLD, SILVER, PLATINUM, PALLADIUM, OSMIUM, IRIIDIUM, ETC.

Buyers of

MINERALS, ORES, CONCENTRATES, SWEEPS, LEMELS AND RESIDUES
containing GOLD, SILVER, PLATINUM, COPPER, TIN, ZINC, LEAD

Smelting and Refining Works:

BRIMSDOWN, MIDDLESEX

Also at:

NEW YORK :: ADELAIDE
JOHANNESBURG
SALISBURY (Rhodesia)

MEMBERS OF THE LONDON METAL EXCHANGE

LEONARD COHEN LTD.

PRECIOUS METALS

ELECTROLYTIC COPPER WIREBARS & CATHODES

TIN — LEAD — ZINC

NON-FERROUS METAL INGOTS

ORES — CONCENTRATES — SCRAP METALS

London Office:

1 HAY HILL, W.1

Telephone: GROSVENOR 6284

Works:

PORTH, GLAM.

Telephone: PORTH 280

ENTORES, LIMITED

KINGS HOUSE, 36 & 37 KING STREET,
LONDON, E.C.2.

NON-FERROUS METALS
ORES · RESIDUES

Telegrams:
Entores, Phone, London

Telephone:
MONarch 3415

Telex No:
London 8455

EASTERN SMELTING CO. LTD.

Head Office: ST. SWITHIN'S HOUSE, 11/12 ST. SWITHIN'S LANE, LONDON, E.C.4

Telephone: MANsion House 2164/8

Telegrams: TIMAMASA, PHONE LONDON

Smelting Works: PENANG, FEDERATION OF MALAYA

TIN SMELTERS

BRANCHES THROUGHOUT THE FEDERATION OF MALAYA

Sole Selling Agents: VIVIAN, YOUNGER & BOND, LIMITED, PRINCES HOUSE, 95 GRESHAM STREET, LONDON, E.C.2

Telephone: MONARCH 7221/7
Telex: LONDON 9665

Telegrams: BOND, STOCK, LONDON
Cables: BOND, LONDON

ZINC SHAVINGS GRANULATED & POWDERED NON-FERROUS METALS

"Lead Wool" for Pipe-jointing.
Metallic Packing for Pumps, etc.

THE LEAD WOOL CO., LTD.
SNODLAND KENT

Telephone: Snodland 84216 & 7 Telegrams: "Strength, Phone, Snodland"

J. & J. MAYBANK LTD.

This Company backed with the vast experience gained in a 100 YEARS of progressive trading, will expedite all orders . . .

THE BUYING OF MIXED OR SORTED NON-FERROUS SCRAP METALS and Supplying of Finely Graded Non-Ferrous Scrap to Your Requirements

J. & J. MAYBANK LTD.

DEPTFORD WHARF, GREENWICH HIGH ROAD,
LONDON, S.E.18. Telephone: TIDeway 5351
(10 lines)

J. LOWENSTEIN & CO. LTD.

GREENWICH HOUSE,
18/13 NEWGATE STREET, LONDON, E.C.1
Telephone: City 8401 (7 lines)

ORES - METALS - RESIDUES

CUPELS

MAGNESIA CUPELS and ASSAY MATERIAL
"MABOR" BRAND, as supplied to MINTS,
MINES and ASSAYERS throughout the World.

MABOR (1944) LIMITED
(Founded 1900)

THE PIONEERS OF MAGNESIA CUPELS
Registered Office: 310 Winchester House, London, E.C.2
Phone: London Wall 5089 Tel. Address: Maborlim, London
Agencies: SALEM, INDIA: MONTREAL, CANADA:
PERTH, W.A.

Supplies through Agents, the Trade, or direct.

TINPLATES - BLACKPLATES

Strips, Circles, Printers' Waste

EXPORT & HOME MARKET

Prompt attention to all enquiries

BAYSWATER METAL SUPPLY CO.
34, WOOD LANE,
LONDON, W.12. ENGLAND

Phone: SHE 7025/6

Cables: ALMETSUP, LONDON

International Smelters and Buyers of

NON-FERROUS SCRAP METALS AND RESIDUES

TIN
LEAD
WHITEMETAL
SOLDER
GUNMETAL
COPPER

THE EYRE SMELTING CO LTD

Tandem Works, Merton Abbey, London, S.W.19

Phone: Mitcham 2031

Wire: Eyresmeltin, Phone, London

EVERITT & Co. LTD.

40 CHAPEL STREET
LIVERPOOL

Teleg. Address: Persistent, Liverpool

Phone: 2995 Central

SPECIALITY

MANGANESE PEROXIDE ORES,

We are buyers of:—

WOLFRAM, SCHEELITE, MOLYBDENITE
VANADIUM, ILMENITE, RUTILE,
ZIRCONIUM and TANTALITE ORES

Suppliers of:—

FERRO-ALLOYS & METALS NON-FERROUS ALLOYS

CHARLES KERRIDGE

● SCRAP LEAD ● BATTERY PLATES
● COPPER CABLES ● NON-FERROUS CONTENTS
FENCEPIECE ROAD, CHIGWELL, ESSEX

Telephones:
Hainault 2903, Larkwood 3863

Telegrams:
Metallia East Phone London

"Tropag"

ASBEST-& ERZIMPORT OSCAR H. RITTER K. G.
Hamburg :—: Ballindamm 7

ASBESTOS - ORES - MINERALS

Import Export Transit



★ **MINERALS**

★ **METALS**

★ **ORES**

of every description

J.C. Gilbert Ltd

COLUMBIA HOUSE, ALDWYCH, LONDON, W.C.2.

AGENTS IN MOST COUNTRIES THROUGHOUT THE WORLD

we buy
**CONCENTRATES
ORES RESIDUES**
containing
**Base and Precious
METALS**

E. M. JACOB & CO. LTD.

Members of the London Metal Exchange

**GREENWICH HOUSE, 10-13 NEWGATE ST.,
LONDON, E.C.1**

Telephone: CITY 8401 (7 lines) Cables: JACOMETA, LONDON
Telex No: LONDON 8655

ROKKER & STANTON LTD.

DRAYTON HOUSE, GORDON STREET
LONDON, W.C.1

Metal Stockists & Shippers

for

**BRASS, COPPER, ALUMINIUM
AND NICKEL SILVER**

in

Sheets, Rods, Tubes, Strip, Wire, etc.

Associated Companies in Holland and Belgium
also Regd. in South Africa and Rhodesia

Tel: EUS 4751/2 Cables: BENTLEY 2nd, A.B.C.6
Grams: ROKKER, WESTCENT, LONDON

**MINING &
CHEMICAL
PRODUCTS
LIMITED**

**86 Strand
London WC2
Telephone
Temple Bar
6511/3**

**Buyers of Ores,
Concentrates
and Residues of**

**BISMUTH
SILVER
SELENIUM**

COLLINGRIDGE & CO., LTD.

Refiners of all precious metal wastes

Buyers of:—**MERCURY** (Quicksilver) and all scrap
materials containing **GOLD, SILVER, PLATI-
NUM**, etc. Aircraft Plugs, Silver Solder, Copper/
Silver Alloys, Platinum and Silver Contacts, Photo-
graphic Residues, Old English Gilt Picture Frames,
Old or Out-dated X-Ray Films.

**RIVERSIDE WORKS, RIVERSIDE ROAD,
WATFORD, HERTS.**

Tel.: Watford 5963

Estd. 1800

GEORGE T. HOLLOWAY Co. LTD.

Metallurgists & Assayers

ORE TESTING, WORKS AND METALLURGICAL
RESEARCH LABORATORIES

**Atlas Road, Victoria Road, Acton,
LONDON, N.W.10**

Telephone :
ELGAR 5202

Grams and Cables :
NEOLITHIC LONDON

THE STRAITS TRADING COMPANY, LIMITED

Head Office :

P.O. Box 700, OCEAN BUILDING, SINGAPORE

Works :

SINGAPORE & PENANG

"The Straits Trading Co., Ltd."
Brand of Straits Tin

THE BRITISH TIN SMELTING COMPANY, LIMITED

Works : LITHERLAND, LIVERPOOL

Smelters of Non-ferrous Residues and Scrap

London Agents:

W. E. MOULSDALE & CO., LTD.

2 Chantrey House, Eccleston Street, London, S.W.1
Cables : Wameoulanco, London Telephone : SLOane 7288/9

RADIOMETRIC & GEOPHYSICAL SURVEYS LIMITED

*Specialists in Radiometric assays for
Uranium and Thorium*

SPECIAL 48 HOUR ASSAY SERVICE
NORMAL SERVICE 7 - 10 DAYS

173 LONDON ROAD,
MITCHAM, SURREY.

Telephone:
MITcham 2006-7

DEERING PRODUCTS LTD.

8 GREAT SMITH STREET, LONDON, S.W.1

**ORES - MINERALS - REFRACTORY
RAW MATERIALS**

Telephone: ABBEY 2681/2

Cables: PRODEERING, LONDON

HARRIS PLASTICS (RICHMOND) LTD.

FOR ALL SCRAP METALS

Specialities:—

NICKEL MOLYBDENUM TUNGSTEN

MANOR PARK, RICHMOND, SURREY Phone: 0028

HENEAGE METALS

for Quality Ingots

IN BRASS, GUN METAL
& PHOSPHOR BRONZE.

PHONE ASTON CROSS 1177/8

HENEAGE METALS LTD. HENEAGE ST. BIRMINGHAM.

Cables:
Alreco, London

Telephone:
Trafalgar 5922 (8 lines)

Telex:
2-2462

ALRECO METAL CORPORATION LTD.

(Members of the London Metal Exchange)

ORES :: MINERALS

RESIDUES METAL ALLOYS

SEMI-FINISHED

NON-FERROUS METAL PRODUCTS

1-3 ROBERT STREET, LONDON, W.C.2.

OFFICES AT NEW YORK AND BRUSSELS

Contractors for Ores, Concentrates & Residues
containing

LEAD

ZINC · COPPER · ANTIMONY · WOLFRAM

LEOPOLD LAZARUS LTD.

CITY WALL HOUSE, FINSBURY PAVEMENT, LONDON, E.C.2

Telephone: METROPOLITAN 8831 Cables: ORMINLAZ, LONDON
OFFICES AT SYDNEY, CALCUTTA AND JOHANNESBURG

METAL TRADERS LTD.

7 GRACECHURCH ST., LONDON, E.C.3

Telegrams:
Serolatam, Stock, London

Telex No:
London 2-2610

Telephone:
MANsion House 2544

Buyers and Sellers of
**NON-FERROUS METALS
ORES AND MINERALS**

New York Associates:
Metal Traders Inc., 67 Wall Street

BROOKSIDE METAL CO. LTD.

(Owned by Metal Traders Ltd.)

HONEYPOT LANE, STANMORE, MIDDX.

Telegrams:
Aluminium, Stanmore

Telephone:
EDGware 5544

Buyers and Sellers of
NON-FERROUS SCRAP METALS

Specialists in
COPPER-BEARING MATERIALS

SPANISH VIRGIN

QUICKSILVER

(Mercury)

Spanish Virgin Quicksilver produced at the world
famous Almaden Mine is renowned for its consistent
high purity

Representatives for British Commonwealth and other countries

ELDER, SMITH & CO., LIMITED
3, ST. HELEN'S PLACE, LONDON, E.C.3.

Phone: LONdon Wall 5201 (8 lines) Cables: BARRELDER, LONDON

The Mining Journal 1955 ANNUAL REVIEW NUMBER

Summarizes events and statistics of 1954

Orders for Copies should be placed
direct or through Newsagent

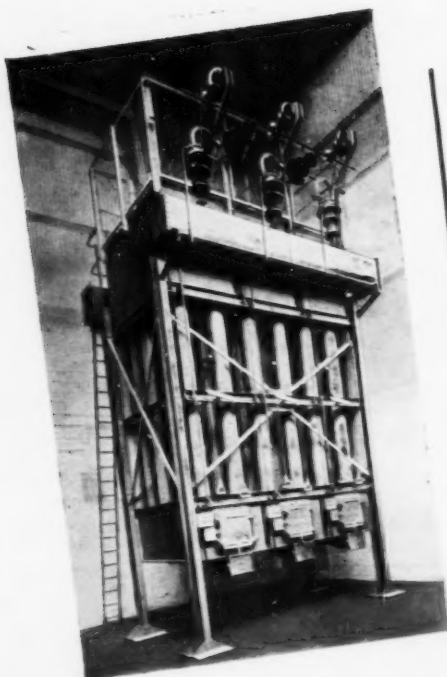
Is now on sale — Price 7/6

Write: THE PUBLISHER, Mining Journal,
15 Wilson Street, Moorgate, London, E.C.2

MACHINERY & EQUIPMENT DIRECTORY

Buyers will find the addresses of the companies listed below in the advertisement pages of our recent issues. Alternatively, enquiries may be addressed to *The Mining Journal*, 15 Wilson Street, London, E.C.2. Phone: MO'Narch 2567.

- AGITATORS**
Denver Equipment Co. Ltd.
- AIR-HOSE COUPLERS**
Victor Products (Wallsend) Ltd.
- BALL MILLS**
Fraser & Chalmers Eng'g Wks.
Hadfields Ltd.
- BALL MILL LINERS**
Hadfields Ltd.
- BALLS FOR MILLS**
Brindley (F. J.) & Sons (Sheffield) Ltd.
- BATTERIES**
Britannia Batteries Ltd.
- BEARINGS**
British Timken Ltd.
- BELTING — RUBBER & FIRE RESISTANT**
British Belting & Asbestos Ltd.
British Tyre & Rubber Co. Ltd.
Dunlop Rubber Co. Ltd.
Turner Bros. Asbestos Co. Ltd.
- BOOTS — MINER'S SAFETY**
Wilkins & Denton Ltd.
- BOREHOLE & DRILLING CONTRACTORS**
(Overseas) Ltd.
Conrad Stork Huisch, N.V.
Craelius Co. Ltd.
Thom (John) Ltd.
- BRAKE & CLUTCH LININGS**
British Belting & Asbestos Ltd.
Small & Parkes Ltd.
Turner Bros. Asbestos Co. Ltd.
- CABLES**
British Insulated Callender's Cables Ltd.
Edison Swan Electric Co. Ltd.
- CABLEWAYS & ROPEWAYS**
Ceretti & Tanfani Ropeway Co. Ltd.
- CALCINING PLANT**
Fraser & Chalmers Eng'g Wks.
- CASTINGS**
Hadfields Ltd.
- CEMENTATION**
Cementation Co. Ltd.
- CHEMICALS**
I.C.I. (Gen. Chem. Div.)
- CLASSIFIERS**
Denver Equipment Co. Ltd.
Holman Bros. Ltd.
- CLUTCHES — FRICTION**
British Belting & Asbestos Ltd.
Small & Parkes Ltd.
Turner Bros. Asbestos Co. Ltd.
Wigglesworth (F.) & Co. Ltd.
- COAL BREAKERS**
Hadfields Ltd.
- COAL CUTTERS**
Joy-Sullivan Ltd.
- COAL WASHING PLANT**
Fraser & Chalmers Eng'g Wks.
- COMPRESSORS — AIR**
Atlas Diesel Co. Ltd.
Consolidated Pneumatic Tool Co. Ltd.
Holman Bros. Ltd.
Lead Wool Co. Ltd.
Ward (Thos. W.) Ltd.
- CONCENTRATING TABLES**
Davies Magnet Works Ltd.
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.
Knapp & Bates Ltd.
- CONCRETE MIXERS**
Ransomes & Rapier Ltd.
- CONVEYORS**
Broadbent (Robt.) & Son Ltd.
Fraser & Chalmers Eng'g Wks.
Mitchell Engineering Ltd.
Moxey Conveyor & Transporter Co. Ltd.
Wood (Hugh) & Co. Ltd.
- CRANES**
Ward (Thos. W.) Ltd.
- CRAWLER TRACTORS**
Mackay Industrial Equipment Ltd.
Marshall Sons & Co. Ltd.
- CRUSHERS — JAW**
Broadbent (Robt.) & Son Ltd.
Fraser & Chalmers Eng'g Wks.
Hadfields Ltd.
Nordberg M'Fg. Co. Ltd.
Sheepbridge Eng'g Ltd.
- CRUSHERS — GYRATORY**
Hadfields Ltd.
Nordberg M'Fg. Co. Ltd.
Sheepbridge Eng'g Ltd.
- CYANIDE PLANTS**
Denver Equipment Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Knapp & Bates Ltd.
- DIAMONDS — INDUSTRIAL**
Smit (J. K.) & Sons Ltd.
Van Moppes (L. M.) & Sons Ltd.
Wolverhampton Diamond Die & Tool Co. Ltd.
- DRAGLINE BUCKETS**
Hadfields Ltd.
Olding (Jack) & Co. Ltd.
- DREDGE BUCKETS**
Hadfields Ltd.
- DREDGES**
Ruston Bucyrus Ltd.
- DRILL BITS — DETACHABLE**
Holman Bros. Ltd.
Rip Bits Ltd.
Victor Products (Wallsend) Ltd.
- DRILL BITS — DIAMOND**
Craelius Co. Ltd.
Smit (J. K.) & Sons Ltd.
Van Moppes (L. M.) & Sons Ltd.
- DRILL RIGS**
Conrad Stork Huisch, N.V.
Joy-Sullivan Ltd.
Ruston Bucyrus Ltd.
Siemens-Schuckert (G.B.) Ltd.
- DRILL RODS**
Holman Bros. Ltd.
Rip Bits Ltd.
Victor Products (Wallsend) Ltd.
Wood (Hugh) & Co. Ltd.
- DRILL SHARPENERS**
Holman Bros. Ltd.
- DRILL STEEL**
Brindley (F. J.) & Sons (Sheffield) Ltd.
Consolidated Pneumatic Tool Co. Ltd.
Hadfields Ltd.
Victor Products (Wallsend) Ltd.
- DRILLS — DIAMOND & CORE**
Consolidated Pneumatic Tool Co. Ltd.
Craelius Co. Ltd.
Joy-Sullivan Ltd.
Smit (J. K.) & Sons Ltd.
- DRILLS — PROSPECTING**
Conrad Stork Huisch, N.V.
Ruston Bucyrus Ltd.
- DRILLS — ROCK**
Atlas Diesel Co. Ltd.
Consolidated Pneumatic Tool Co. Ltd.
Holman Bros. Ltd.
Siemens-Schuckert (G.B.) Ltd.
Victor Products (Wallsend) Ltd.
Wood (Hugh) & Co. Ltd.
- EARTH MOVING EQUIPMENT**
Birtley Co. Ltd.
Blackwood Hodge (J.) & Co. Ltd.
Mackay Industrial Equipment Ltd.
Marshall Sons & Co. Ltd.
Premier Plant & Hire Co. Ltd.
Ward (Thos. W.) Ltd.
- ELECTRIC MOTOR & CONTROL GEAR**
British Thomson-Houston Co. Ltd.
General Electric Co. Ltd.
Igranic Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Siemens-Schuckert (G.B.) Ltd.
- ELECTRICAL SWITCHGEAR**
British Thomson-Houston Co. Ltd.
General Electric Co. Ltd.
Igranic Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Siemens-Schuckert (G.B.) Ltd.
Wood (Hugh) & Co. Ltd.
- ELECTRICAL PRECIPITATION**
Lodge Cottrell Ltd.
- EXCAVATORS**
Blackwood Hodge (J.) & Co. Ltd.
Olding (Jack) & Co. Ltd.
Premier Plant & Hire Co. Ltd.
Ransomes & Rapier Ltd.
Ruston Bucyrus Ltd.
- EXPLOSIVES — BLASTING**
I.C.I. (Nobel Division)
- FILTERS**
Denver Equipment Co. Ltd.
- FILTERS — LUBRICATING OILS**
Stream-Line Filters Ltd.
Tecalmit Ltd.
- FILTERS — SWITCH & TRANSFORMER OIL**
Stream-Line Filters Ltd.
- FIRE EXTINGUISHERS**
Nu-Swift Ltd.
Pyrene Co. Ltd.
- FIRST AID EQUIPMENT**
Cuxon Gerrard & Co. Ltd.
- FLEXIBLE JOINTS**
The Unicone Co. Ltd.
- FLOTATION EQUIPMENT**
Denver Equipment Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Huntington, Heberlein & Co. Ltd.
Knapp & Bates Ltd.
- FLOTATION REAGENTS**
I.C.I. (Gen. Chem. Div.)
National Chemical Products Ltd.
- FOUNDATIONS**
Cementation Co. Ltd.
- FURNACES**
Briels Ltd.
Huntington-Heberlein & Co. Ltd.
- GEOGRAPHICAL INSTRUMENTS**
Hilger & Watts Ltd.
- GEOGRAPHICAL & GEOLOGICAL SURVEYS**
Craelius Co. Ltd.
Thom (John) Ltd.
- GRINDING PANS**
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.
- HANDLING PLANT**
Mitchell Engineering Ltd.
Moxey Conveyor & Transporter Co. Ltd.
- HAULAGE GEAR**
Austin Hopkinson & Co. Ltd.
Holman Bros. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Robey & Co. Ltd.
- HELMETS**
Helmets Ltd.
Safety Products Ltd.
Siebe Gorman & Co. Ltd.
- HOISTS**
Austin Hopkinson & Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.
- HOSE — RUBBER**
British Tyre & Rubber Co. Ltd.
Dunlop Rubber Co. Ltd.
- LIGHTING EQUIPMENT**
Edison Swan Electric Co. Ltd.
General Electric Co. Ltd.
Igranic Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Victor Products (Wallsend) Ltd.
- LOCOMOTIVES — DIESEL**
Hunslet Engine Co. Ltd.
Ruston & Hornsby Ltd.
Wood (Hugh) & Co. Ltd.
- LOCOMOTIVES — ELECTRIC**
British Thomson-Houston Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
- LOCOMOTIVES — STEAM**
Hunslet Engine Co. Ltd.
- LUBRICATION — MECHANICAL**
Tecalmit Ltd.
- MAGNETIC SEPARATORS**
Davies Magnetic Works Ltd.
Huntington, Heberlein & Co. Ltd.
Rapid Magnetic Machines Ltd.
- MAGNETS-ELECTRO LIFTING**
Igranic Electric Co. Ltd.
Rapid Magnetic Machines Ltd.
- MINE CARS**
The Distington Eng'g Co. Ltd.
- MINE CAR — WHEELS & AXLES**
Hadfields Ltd.
- MINERS' LAMPS**
Premier Lamp & Eng'g Co. Ltd.
- PICKS — PNEUMATIC**
Atlas Diesel Co. Ltd.
Consolidated Pneumatic Tool Co. Ltd.
Holman Bros. Ltd.
Wood (Hugh) & Co. Ltd.
- PLANT — HIRE**
Premier Plant & Hire Co. Ltd.
Ward (Thos. W.) Ltd.
- POLYVINYL CHLORIDE RESIN**
British Geon Ltd.
- PUMPING EQUIPMENT**
Comet Pump & Eng'g Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.
Ward (Thos. W.) Ltd.
- PUMPS — CENTRIFUGAL**
Comet Pump & Eng'g Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Ward (Thos. W.) Ltd.
- PUMPS — SAND**
Denver Equipment Co. Ltd.
Fraser & Chalmers Eng'g Wks.
- PUMPS — SINKING**
Thom (John) Ltd.
- RAILWAY PLANT & EQUIPMENT**
Jones (Wm.) Ltd.
Ward (Thos. W.) Ltd.
- RESPIRATORS**
Siebe Gorman & Co. Ltd.
- RUBBER PRODUCTS**
British Tyre & Rubber Co. Ltd.
Dunlop Rubber Co. Ltd.
Turner Bros. Asbestos Co. Ltd.
- SAFETY EQUIPMENT**
Safety Products Ltd.
Siebe Gorman & Co. Ltd.
- SCRAPER HAULAGE**
Austin Hopkinson & Co. Ltd.
Holman Bros. Ltd.
Wood (Hugh) & Co. Ltd.
- SCRAPER LOADERS**
Atlas Diesel Co. Ltd.
Eimco (Great Britain) Ltd.
Joy-Sullivan Ltd.
- SCREENING PLANT**
Broadbent (Robt.) & Son Ltd.
Davies Magnet Wks. Ltd.
Fraser & Chalmers Eng'g Wks.
Nordberg M'Fg. Co. Ltd.
- SHAFT SINKING**
Cementation Co. Ltd.
- SHOVEL LOADERS**
Atlas Diesel Co. Ltd.
Eimco (Great Britain) Ltd.
Joy-Sullivan Ltd.
- SURVEYING INSTRUMENTS**
Hilger & Watts Ltd.
- TEST SIEVE VIBRATOR**
The Pascall Eng'g Co. Ltd.
- THICKENERS**
Denver Equipment Co. Ltd.
- TIMBER PRESERVATIVES**
Hickson's Timber Impregnation Co. (G.B.) Ltd.
- TRANSFORMERS**
British Thomson-Houston Co. Ltd.
General Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
- TUBE MILL LINERS**
Hadfields Ltd.
- VEE-ROPE DRIVES**
Wigglesworth (F.) & Co. Ltd.
- WATER SUPPLY EQUIPMENT**
Thom (John) Ltd.
- WELDING**
Cementation Co. Ltd.
- WELDING ELECTRODES**
Metropolitan-Vickers Electrical Co. Ltd.
- WELDING EQUIPMENT**
British Insulated Callender's Cables Ltd.
Lincoln Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Siemens-Schuckert (G.B.) Ltd.
- WIRE ROPE & ACCESSORIES**
British Ropes Ltd.
- WINDING EQUIPMENT — ELECTRIC**
British Thomson-Houston Co. Ltd.
General Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Robey & Co. Ltd.



ELECTROFILTERS

As supplied to refineries for the recovery of

GOLD and SILVER

Plants supplied for the precipitation of all industrial
DUSTS, MISTS and FUMES

Multi-unit installations for
P.F. FIRED BOILERS
BLAST FURNACES
CEMENT PLANTS

LODGE-COTTRELL LTD

GEORGE STREET PARADE, BIRMINGHAM, 3. Telephone: Central 7714

P.25397

"RAPIDITY"
High speed separation and extraction of one magnetic mineral

RAPID

Electro-Magnetic ORE SEPARATORS

For FEEBLY MAGNETIC ORE

These proved machines successfully treat MONAZITE SANDS, TIN SANDS, IRON SANDS, WOLFRAM TIN, CORUNDUM, COLUMBITE, etc.

also
Induced Roll and Cross Belt types for suitable applications

THE RECOGNISED AUTHORITY ON MAGNETIC SEPARATION

"RAPID O.G."
Super Selective separation of one, two, or up to six magnetic minerals, passing from the bulk in one

RAPID MAGNETIC MACHINES LIMITED
LOMBARD STREET, BIRMINGHAM, 12 'Phone: VIC. 1137. 'Grams: "Magnetism", B'ham.